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Report for Preston South,
Eastern Precinct
Environmental Assessment for
Potential Land Development

February 2011



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- A Level 1 Flora and Vegetation Survey
- B Terrestrial Fauna Survey
- C Preliminary Acid Sulphate Soil Investigation
- D Species List



1. Introduction

1.1 Background

GHD was commissioned by the landowners in the Picton South, Eastern Precinct in the Shire of Dardanup, (the Precinct) to review the Environmental Reports previously prepared for their land. The aim of this commission was to develop recommendations that may be considered by the landowners as part of their land development planning for this Precinct. The Precinct is located in the Preston Industrial Park, an area identified in the Greater Bunbury Region Scheme as being developable for industrial purposes.

Specifically, the Lots under investigation are:

- ▶ Lot 1 Martin Pelusey Road;
- ▶ Lot 110 (formerly Lot 2) Martin Pelusey Road;
- ▶ Lot 11 South West Highway
- ▶ Lot 102 Harris Road
- ▶ Lot 104 Columbas Drive
- ▶ Lot 103 Harris Road
- ▶ Lot 603 Martin Pelusey Road

These Lots are shown in Figure 1.

The environmental reports were:

1. Ekologica (2009) *Report on a Level 1 Flora and Vegetation Survey of Various Lots at Picton East*. (Appendix A)
2. Greg Harewood (2009) *Terrestrial Fauna Survey, (Level 1) of Lots 1, 2, 11, 102-104 & 603. Picton East Version 1*. (Appendix B)
3. Strategen (2009) *Preliminary Acid Sulphate Soil Investigation Picton East, Shire of Dardanup*. (Appendix C).

In addition to these commissioned investigations, the recommendations in this report take into account the findings and conclusions of the Environmental Protection Authority's 2008 report: *Advice on Areas of Conservation Significance in the Preston Industrial Park. Advice of the Environmental Protection Authority to the Minister for the Environment under Section 16(e) of the Environmental Protection Act 1986*, Bulletin 1282. Bulletin 1282 identifies areas of conservation significance within the entire Preston Industrial Park. The Lots listed above are included in this EPA report.

In addition to these previously commissioned studies, GHD completed a field visit to the Precinct in October 2010 to verify the conclusions and recommendations put forward in each of the above listed reports. Following the fieldwork GHD, prepared plans that quantified the potential developable land area and the environmental assets for the Picton South, Eastern Precinct. These plans have not been referred to either the federal or state environment agencies for their consideration rather, it is this report's intention that the landowners of the Precinct are provided with the rationale and logic that informs the environmental plan ultimately planned for the Precinct.



It is anticipated that the information presented in this report be the basis for any further reporting requirements that may be made as part of the development of this land wherever environmental reporting is required, for example the preparation of clearing permits.

1.2 Aims of the Study

In broad terms, the aims of this report are to:

- ▶ Review the previously commissioned reports listed above, including a field visit to verify mapping
- ▶ Consider any recommendations concluded in the EPA's 2008 Section 16(e) advice in Bulletin 1282
- ▶ Identify potential land development areas
- ▶ Identify areas for potential environmental protection
- ▶ Identify areas for potential environmental enhancement such as areas for rehabilitation and ecological linkages and
- ▶ Provide environmental advice in terms of referrals and enhancement.

The report assumes a planning position that, to varying degrees, environmental impacts that occur as a result of land development may be managed and indeed some environmental assets may be improved. For example, land development planning may include a requirement to protect known habitat trees, establish ecological linkages and rehabilitate land using local provenance species, including road verges. These principles of protection and enhancement have been applied in this study.

1.3 Location

The Precinct is located south of the South Western Highway and west of Martin Pelusey Rd in Picton East and approximately 10 kilometres south east of the Bunbury City Centre, (Figure 1). The land benefits from excellent access to major transport routes including the South West Highway and is widely regarded as a strategic industrial precinct for the Bunbury Region. The total land area under investigation is approximately 114 ha where the dominant land use is rural (grazing, hay production and horses). A smaller proportion of the land area (Lot 102) is used for general industrial purposes.

There are number of industrial sites already established within the southern precinct of the Preston Industrial Park including self storage, fabrication and logistics.

Lot details are shown in Table 1.



Table 1 Lot Details

Lot Number	Land Area (Ha)	Landowner
Lot 1 Martin Pelusey Road	18.65	Cunningham PE Park Pty. Ltd.
Lot 11 South West Highway	11.91	N & M Brockman
Lot 603 Martin Pelusey Road	34.87	Harris Road Pty Ltd
Lot 103 Harris Road	16.96	Harris Road Pty Ltd
Lot 110 (formerly Lot 2) Martin Pelusey Road	16.90	Westim Pty. Ltd.
Lot 102 Harris Road	6.59	J.G. Radunovich Pty. Ltd.
Lot 104 Columbas Drive	8.58	Smargiassi Nominees

The land owners of Lots 1, 11, 603, 110 and 104 intend to develop their land for industrial purposes.



2. Existing Environmental and Social Context

The environmental and social context and issues relevant to Picton South, Eastern Precinct are presented in this section of the report.

The Environmental Constraints for the Precinct are shown in Figure 2.

2.1 Climate

The project area is situated in a typical Mediterranean climate with warm dry summers and cool wet winters. There is a meteorological station in Bunbury, the nearest recording station to the site, and the recorded climatic data is shown in Table 2.

Table 2 Climatic Data Recorded at the Bunbury Meteorological Station

Mean Annual Maximum Temperature Range:	29.8 °C (January) & 15.7°C (July)
Mean Annual Minimum Temperature Range:	17.2 °C (January) & 7.2 °C (July)
Mean Annual Rainfall:	727.2 mm
Mean Annual Rain days per year:	88.2

(Source: Bureau of Meteorology, 2010)

2.2 Existing Landuse

The Precinct has established rural land on its southern and western boundaries, the South West Highway to the north and Martin-Pelusey Road to the east. The land within this study area is predominately used for rural purposes, with some land (Lot 102) used for general industry.

Main Roads, WA has reserved a road corridor along the eastern boundary of the Picton South, Eastern Precinct for the proposed Bunbury Outer Ring Road.

2.3 Bioregional Context

Western Australia supports 53 biogeographical subregions. The study area is located in the Perth Subregion of the Swan Coastal Plain. The Swan Coastal Plain Bioregion is a low-lying coastal plain, mainly covered with woodlands. It is dominated by Banksia (*Banksia* sp.) or Tuart (*Eucalyptus gomphocephala*) on sandy soils, Swamp Sheoak (*Casuarina obesa*) on outwash plains and Paperbark (*Melaleuca* sp.) in swampy areas.

The Perth Subregion includes a complex series of seasonal wetlands and also includes the many islands found offshore from Perth (McKenzie *et al.*, 2002).

2.4 Vegetation Complexes

Vegetation complex mapping, conducted by Mattiske and Havel (1998) identified the Southern River vegetation complex as being dominant in the study area, with small areas of the Guildford complex present in the south of the East Block. The Southern River Vegetation Complex is described as an Open



Woodland of Jarrah (*Eucalyptus marginata*), Marri (*Corymbia calophylla*) and Banksia species with fringing woodland of Flooded Gum (*Eucalyptus rudis*) and Paperbark (*Melaleuca raphiophylla*) along creek beds and surrounding wetlands. The Guildford complex is a mixture of Open Forest to Tall Open Forest of Marri, Jarrah and Wandoo (*Eucalyptus wandoo*) with occurrences of *Eucalyptus lane poolei* and Flooded Gum (*Melaleuca raphiophylla*).

2.4.1 Vegetation Extent and Status

A vegetation type is considered to be under-represented if there is less than 30 per cent of its original distribution remaining (EPA, 2000).

Table 3 below provides information on the vegetation complexes that occur within the study area. The areas shown in Table 4 reflect the overall extent to which these complexes occur on the Swan Coastal Plain.

Table 3 Vegetation Complex Extents

	Total pre-1750 extent (ha)	Present extent (1997/98) (ha)	% Remaining (1997/98)
Southern River	57,979	11,501	19.8
Guildford	92,497	4,662	5.0

(Department of Environment and Conservation 2009, Native Vegetation online viewer)

The Southern River complex has only 19.8 per cent of its pre-European extent remaining; this makes this vegetation complex 'Vulnerable' according to the Environmental Protection Authority Position Statement No. 2. The Guildford complex is considered 'Endangered' with only five per cent remaining of its pre-European extent.

2.5 Significant Flora

A search of the *EPBC Act 1999* Protected Matters Search Tool identified eleven threatened flora species within a 10 km buffer of the project site. None of these species have been identified in previous site investigations as occurring within the Precinct.

Significant flora species include those that have no protection under either the *EPBC Act 1999* or *WA Wildlife Conservation Act 1950* and species with a limited distribution or considered to be poorly reserved. Of the 31 significant flora species, one species is listed by the DEC as Declared Rare and seven priority listed flora. Protected flora identified from an *EPBC* protected matter search within a 10 km buffer and Declared Rare and Priority listed flora known to occur within the Precinct are listed in Table 4.

Table 4 Protected Flora

Species	Status EPBC	DEC
<i>Acacia flagelliformis</i>		P4
<i>Andersonia gracilis</i>	Endangered	DRF
<i>Aponogeton hexatepalus</i>		P4
<i>Banksia nivea</i> subsp. <i>uliginosa</i>	Endangered	DRF
<i>Banksia squarrosa</i> subsp. <i>argillacea</i>	Vulnerable	DRF
<i>Brachyscias verecundus</i>	Critically endangered	DRF
<i>Caladenia huegelii</i>	Endangered	DRF
<i>Caladenia procera</i>	Critically Endangered	DRF
<i>Caladenia speciosa</i>		P4
<i>Centrolepis caespitosa</i>	Endangered	P4
<i>Chamelaucium</i> sp. C Coast Plain (RD Royce 4872)	Vulnerable	DRF
<i>Darwinia foetida</i>	Critically Endangered	DRF
<i>Diuris drummondii</i>		DRF
<i>Ornduffia submersa</i>		P4
<i>Pultenaea skinneri</i>		P4
<i>Synaphea stenoloba</i>	Endangered	DRF
<i>Verticordia attenuata</i>		P3
<i>Verticordia plumosa</i> var <i>vassensis</i>	Endangered	DRF

2.6 Fauna

2.6.1 Significant Fauna Species

The conservation status of fauna species is assessed under State and Commonwealth Acts, in particular the *Western Australian Wildlife Conservation Act 1950* and the *EPBC Act 1999*.

In Western Australia, Significant Fauna is protected under the *Western Australian Wildlife Conservation Act 1950*, which is enforced by the DEC. A search was conducted of the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Protected Matters search engine and the DEC's



Vulnerable, Endangered and Priority Fauna database to identify protected species which may be present in the project area. The search identified one Endangered, two Vulnerable, and five Migratory bird species and three Vulnerable mammal species. These are listed in Table 5. Migratory species are unlikely to be impacted by the activity proposed due to their transient nature and distance from the coast.

Table 5 Protected Fauna potentially occurring over the site (EPBC Act 1999)

Scientific name	Common Name	Status (EPBC Act 1999)	DEC 2010
Birds			
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	Vulnerable	Vulnerable
<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo, Long-billed Black Cockatoo	Vulnerable	Endangered
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo, Short-billed Black Cockatoo	Endangered	Endangered
Mammals			
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	Vulnerable	Vulnerable
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	Vulnerable	Vulnerable
<i>Setonix brachyurus</i>	Quokka	Vulnerable	Vulnerable
Migratory			
<i>Apus pacificus</i>	Fork-tailed Swift	Migratory	
<i>Ardea alba</i>	Great Egret, White Egret	Migratory	
<i>Ardea ibis</i>	Cattle Egret	Migratory	
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	Migratory	
<i>Merops ornatus</i>	Rainbow Bee-eater	Migratory	

2.6.2 Threatened Ecological Communities

EPA policy states that 'there is a presumption that all areas of remnant native vegetation containing threatened ecological communities or vegetation of the major landform elements, of which less than 10 per cent currently remains, will be retained and conserved' (EPA 2008 Bulletin 1282)

There are no threatened ecological communities known to occur within the Precinct or in a 1 km radius of the site.

2.7 Environmentally Sensitive Areas

There are no Environmentally Sensitive Areas with the Picton South, Eastern Precinct.



2.8 EPA Assessed values of the Proposed Conservation Area

The EPA investigated the remnant vegetation that occurs within the Precinct for potential significance and enhancement potential. The findings of these investigations and the recommendations that are relevant to this report are presented below.

The EPA investigations areas immediately relevant to the Precinct are Investigation Areas 6 and 7, (Figure 3).

The environmental qualities for these Investigation Area's were assessed by the EPA for six criteria. Not all criteria are relevant to the Investigation Areas.

Table 6 EPA Bulletin 1282 Assessment of Criteria for Regional Significance of Lots for proposed conservation within the Preston Industrial Park, Northern Precinct

Area	6	7
Representative of Communities	Yes	Yes
Diversity		
Rarity	Yes	Yes
Maintenance of Processes	Yes	Yes
Scientific or Evolutionary		
Wetland Protection		Yes

2.8.1 Investigation Area 6

Investigation Area 6 includes Lot 104 Columbas Drive, Lot 1 Martin Pelusey Road, Lot 603 Martin Pelusey Road. The attributes of Investigation Area 6 meet three criteria:

These criteria are:

Representation of Ecological Communities:

Representation area of natural vegetation in degraded to completely degraded condition of the Guildford and South River Vegetation complexes.

Rarity

Location for one threatened bird species (Red Tailed Black Cockatoo) and at least four bird species listed as conservation significant on the Swan Coastal Plain.

Maintain Ecological process or Natural Systems

Part of a regional ecological linkage: McLarty / Kemerton / Twin Rivers / Preston River / Gwindinnup (north-south ecological linkage).



2.8.2 Investigation Area 7

Investigation Area 7 includes Lots 104 Columbas Drive and Lot 102 Harris Road. The attributes of Investigation Area 7 meet four criteria

Representation of Ecological Communities:

Representation area of natural vegetation of Good to Very Good condition of the Guildford Vegetation complex.

Rarity

Location for three priority and five poorly reserved flora

Location for two threatened species (Baudin's and Red-tailed Black Cockatoo), one threatened mammal species (Western Ringtail Possum), and at least three bird species listed as conservation significant on the Swan Coastal Plain.

Maintain Ecological Process or Natural Systems

Part of a regional linkage: McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup (north-south ecological linkage)

General Criteria for the Preston of Wetland Stream and Estuarine Fringing vegetation and Coastal Vegetation

The area contains one Environmental Protection Policy (EPP) Lake and two likely Conservation Category Wetlands, (CCW). These wetlands do not occur on the Lots that are contributing to this study.

While some of the above listed environmental values occur on Lot 104. The majority of these environmental values are concentrated in Lot 200 Harris Road, immediately south of Lot 104. Lot 200 is not included in the study area considered in this report.

2.8.3 EPA Summary

The EPA makes two key recommendations in its assessment of the Preston Industrial Park which have been applied in the planning for this Precinct.

The first is that ecological linkages are an important feature of the Preston Industrial Park and that those ecological links already established should be retained.

The second is that the Guildford vegetation complex in this Precinct is some of the best representation of this complex in the entire Park and should be retained.

The majority of the Guildford formation occurs in Lot 200 Harris Road which is outside the scope of this strategic environmental assessment however, there is a portion of the Guildford complex that can be found in both Lots 102 and 104 and it is probable that the EPA will seek to protect these areas.

These points have been acknowledged in the conceptual environmental plan proposed for this Precinct.



2.9 Heritage and Social Issues

2.9.1 European Australian Heritage

A search of the Commonwealth heritage registry found no European heritage sites located within the project area. The State inventories returned no listed European heritage sites.

2.9.2 Indigenous Heritage

A search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System indicates that there were no sites of indigenous heritage value either within or close to the area that is the focus of this report.

Site 4872 (Bunbury 22), as shown in Figure 2 only slightly intersects the western boundary of the Preston Industrial Park, Northern Precinct and therefore unlikely to be impacted by any Park activities.



3. Additional Investigations: Flora and Fauna

3.1 Flora Investigations: Picton South; Eastern Precinct

Ekologica (2009) completed a spring flora survey of the Precinct (Appendix A). The survey found that 79 per cent of the remnant vegetation in the Precinct was 'Completely Degraded', nine per cent was in 'Degraded' condition and 12 per cent in 'Good' condition. The report acknowledges the EPA's 2008 assessment of the Precinct which notes that the remnant vegetation in the Precinct represents degraded examples of the 'Southern River' and 'Guildford' vegetation complexes. This is shown in Figure 4 in this report and Figure 3 in the Ekologica (2009) report.

Ekologica (2009) concludes its report with the statement:

'even though both of these vegetation complexes are currently in a degraded condition, it is important to conserve as much as possible of the vegetation types and to take steps, where practicable to restore areas of vegetation within both the vegetation complexes.' p 13

GHD's spring 2010 field study concurs with the Ekologica findings. The 2010 GHD investigation found that most of the vegetation was 'Degraded' with little evidence of recruitment and virtually no understorey. The remnant vegetation reflected the impact of the surrounding rural land use for example, the history of chemical and fertiliser use, grazing pressure and weed encroachment. While the vegetation is in largely poor condition, if fenced, it is likely that recruitment will occur and result in an improvement in vegetation condition over time.

The key recommendation put forward by both studies, as part of the consideration of land development in the Precinct, is the protection, where possible of the Vulnerable, Southern River and Endangered, Guildford Vegetation Complexes.

3.2 Fauna Investigations: Picton South, Eastern Precinct

Harewood, (2009) completed an opportunistic fauna survey in the Precinct and observed a total of 45 native species. These are listed in Appendix C of Harewood's report (Appendix B). Harewood recorded evidence of four listed threatened species including all three species of Black Cockatoo, with the Red-tailed Black Cockatoo being observed, the Western Ringtail Possum and the migratory species, Rainbow Bee-eater and Great Egret. This evidence is shown as Figure 5 in this report and Figure 4 in Harewood's Report.

Harewood listed nine recommendations that will minimise the impact of any proposed development. These recommendations include:

- ▶ the protection of remnant vegetation;
- ▶ that remnant vegetation is not fragmented; and
- ▶ any revegetation to use local provenance species.

GHD recommends that all nine listed recommendations are considered and, where possible, applied in future land development planning and associated works that occur within the Precinct.

GHD's 2010 field work principally reviewed the findings shown in Figure 5, where evidence of the threatened species, specifically, Black Cockatoo's and Western Ringtail Possums had been mapped.



This field investigation confirmed the mapping detail presented by Harewood, with the evidence of active dreys, recent scats and foraging and habitat trees being readily observed.

As a result of these findings, GHD agrees with Harewood's conclusion that:

'planning of the proposal should take into account the potential presence of several species of conservation significance and impact on these species will need to be minimised so as to simplify any referral or assessment process required under the federal EPBC Act or the state administered EPA Act. '(p 19).

In considering this recommendation, the proposed land development plan presented at the end of this report intentionally retains the areas where evidence of threatened species was mapped.

3.3 Acid Sulphate Soils

Strategen (2010) completed a preliminary acid sulphate soil investigation in May 2010 (Appendix C). This study found that:

'there is a potential for AASS in the vicinity of Lots 11 and 102..... however further detailed work will be required to confirm this to be the case.'

This work will only be required if land is to be excavated. The majority of the Precinct is at low risk of ASS and on the basis that most of the land will require fill, it is unlikely that ASS will become a significant environmental issue.

GHD did not undertake additional ASS investigations and supports the conclusion that ASS is unlikely to be a significant environmental issue in the Precinct.



4. Summary Points for Consideration

This report brings together the findings of a number of commissioned investigations and presents a proposed environmental protection and rehabilitation plan for the Precinct. The report proposes environmental considerations that maybe strategically considered in any future land development planning intended for these Lots.

Finally, the report quantifies the percentage of each Lot that is recommended for environmental protection. The following section summarises the logic and approach in determining these areas and types of environmental protection.

4.1 Priority vegetation for protection

Based on the assumptions and key points in this report, Figure 6 identifies the areas of vegetation that are recommended to be included as part of any land development planning for the Precinct.

These areas have been identified based on the above mentioned precepts and totals about 12.83 hectares. There are three main areas for consideration in the planning:

- ▶ The Southern River Complex on Lot 1 Martin Pelusey Road
- ▶ The habitat and foraging vegetation in Lots 104 Columbas Drive, Lot 102 Harris Road and part thereof of Lot 603 Martin Pelusey Road; and
- ▶ The ecological linkage value of the vegetation in the north east of 104 Columbas Drive.

These areas have emerged as the environmental assets in the Precinct as having the highest strategic environmental value and are therefore taken forward as the basis for consideration for the next phase of structure planning.

4.2 Potential environmental protection and rehabilitation areas

Potential areas for land development in the Precinct have been prepared on the basis of the recommendations of the commissioned investigations. The proposed areas for protection and rehabilitation are shown in Figure 6.

The proposed planning considers:

Retained Vegetation

The vegetation recommended for retention occurs in Lots 1, 102 and 104 and a small section of road reserve. These are shown as 'orange' in Figure 6. The area equates to approximately 9.36 hectares and the boundaries align with the observations of habitat and forage trees mapped by Harewood 2009. This recommendation also retains the Southern River and Guildford vegetation complexes identified by the EPA.

In retaining this vegetation, land owners will not be invoking the requirement to refer this land development proposal to the Department of Sustainability, Water, Environment, Populations and Communities (SWEPC) under the *Environmental Protection and Biodiversity Act* 1999, (EPBC Act) as all identified habitat and forage trees for both the Western Ringtail Possum and Black Cockatoo's are



retained. Should this proposed area for rehabilitation be altered, then this conclusion may become redundant.

Ecological linkages

Figure 6 shows attention to an overall ecological link (blue arrow) for the Eastern Precinct being established on parts of Lots 1 and 603 Martin Pelusey Road and Lot 11 South West Highway. This link joins the remnant vegetation area of the Southern River Complex mapped by Ekologica (2009) on Lot 1 Martin Pelusey Road with the vegetation supporting vulnerable and threatened fauna on Lot 603 Martin Pelusey Road.

Ideally, in terms of structure planning this link would align with the road network and species vegetated along the road verge would be local provenance and support local fauna, particularly black cockatoos and possums. This report does not quantify an ideal road width to meet this outcome. In broad terms, the road verge should ideally be as wide as practical.

In broader terms, the ecological links planned for the Precinct have been planned with the intent to complement other linkages planned for the Preston Industrial Park. These include Lot 105 Columbas Drive, immediately west of Lot 603 Martin Pelusey Road and Lot 11 South West Highway.

This commitment to establish and retain the integrity of the ecological links is in keeping with the environmental objectives published in the *South West Regional Ecological Linkages Technical Report*, (WALGA 2009) to enable the effective recognition of ecological linkages in land use planning policy and procedures.

A recommended rehabilitation species list is shown in Appendix D.

Rehabilitation

The area proposed for rehabilitation is shown in Figure 6 in 'purple'. This equates to 3.47 hectares. This land was identified by Ekologica (2009) as being a mix of Southern River and Guildford formation vegetation and by Harewood (2009) as supporting threatened and vulnerable fauna. The permanent protection and rehabilitation of this vegetation will enhance the already existing environmental values and establish an important link between the areas of vegetation recommended for protection.

In retaining and rehabilitating this area of vegetation, the owners will not be required to refer the land development proposal intended for Lot 603 to the Department of Sustainability, Water, Environment, Populations and Communities under the EPBC Act, as the habitat for WRTTP recorded in the Harewood investigation and confirmed by GHD will be retained. Should this proposed area for rehabilitation be altered, then this conclusion may become redundant.

A list of species suitable for planting is shown in Appendix D.

4.3 Implications

The overall area of land proposed rehabilitation and protection in the Precinct is 13.39 hectares and equates to approximately 11.71 per cent of the total land area of the Precinct. While this overall percentage is relatively small, the implication of these recommendations is more significant for some Lots than others, for example Lot 104 Columbas Drive where greater than 60 per cent of the land area is recommended to be retained.



The implication of the areas identified for potential protection and rehabilitation is quantified for each Lot area in Table 6.



Table 7 Implications of the Environmental Protection and Rehabilitation for Lots in Picton South, Eastern Precinct

Lot	Protection (Ha)	Rehabilitation (Ha)	Linkage (Ha)	% area
1 Martin Pelusey Road	2.02			11
11 South West Highway			Exact area to be determined as part of the final road design	
603 Martin Pelusey Road		3.47		10
104 Columbas Drive	5.48			64
102 Harris Road	1.86			28
Reserve 39091 ¹		0.55		100

4.4 Land development requirements

The content of this report principally focuses on the retention and rehabilitation of the environmental assets that have been identified as occurring within the Precinct. There is however vegetation that is established across the Lots that has not been discussed in any detail. For example, a proportion of vegetation established on Lot 603 has not been recommended for either retention or rehabilitation.

On the basis that the environmental assets of the Precinct are protected and enhanced, it is assumed that the remaining land area is developable. In order to develop this land, applications to clear will be required to be submitted to the Department of Environment and Conservation, under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (WA).

¹ Reserve 39091 is located in the Road Reserve on the western boundary of Lot 603.



5. Recommendations

The strategic advice presented in this report has been drawn from three previous environmental studies and a further field investigation completed by GHD in addition to the investigations and recommendations put forward by the EPA.

The outcomes of these investigations conclude that whilst the majority of the land area is degraded, in terms of its environmental value, there are pockets of vegetation that provide both a regional legacy in terms of important vegetation communities and complexes, as well as the potential to improve their habitat and ecological value.

Investment into the protection and enhancement of the environmental linkages in Lots bordering this study area, for example Lot 105 Columbas Drive and land in the Preston Industrial Park, Northern Precinct, further enhance the environmental recommendations put forward in this report.

In summary the key points that may be drawn from each of the studies are:

- ▶ The environmental value of the Guildford and Southern River vegetation complexes and advice to retain these where possible;
- ▶ Retain the maximum area of foraging and habitat trees of the Vulnerable and Threatened fauna species such that referral to the Department of Sustainability, Water, Environment, Population and Communities is not required;
- ▶ Establish and maintain ecological links within the Park to maintain genetic diversity and foraging requirements of the established populations;
- ▶ Prepare and submit clearing applications to the Department of Environment and Conservation.

These key aspects have been taken into account in the preparation of the final conceptual plan for the Picton South, Eastern Precinct.

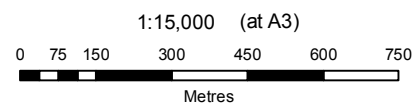
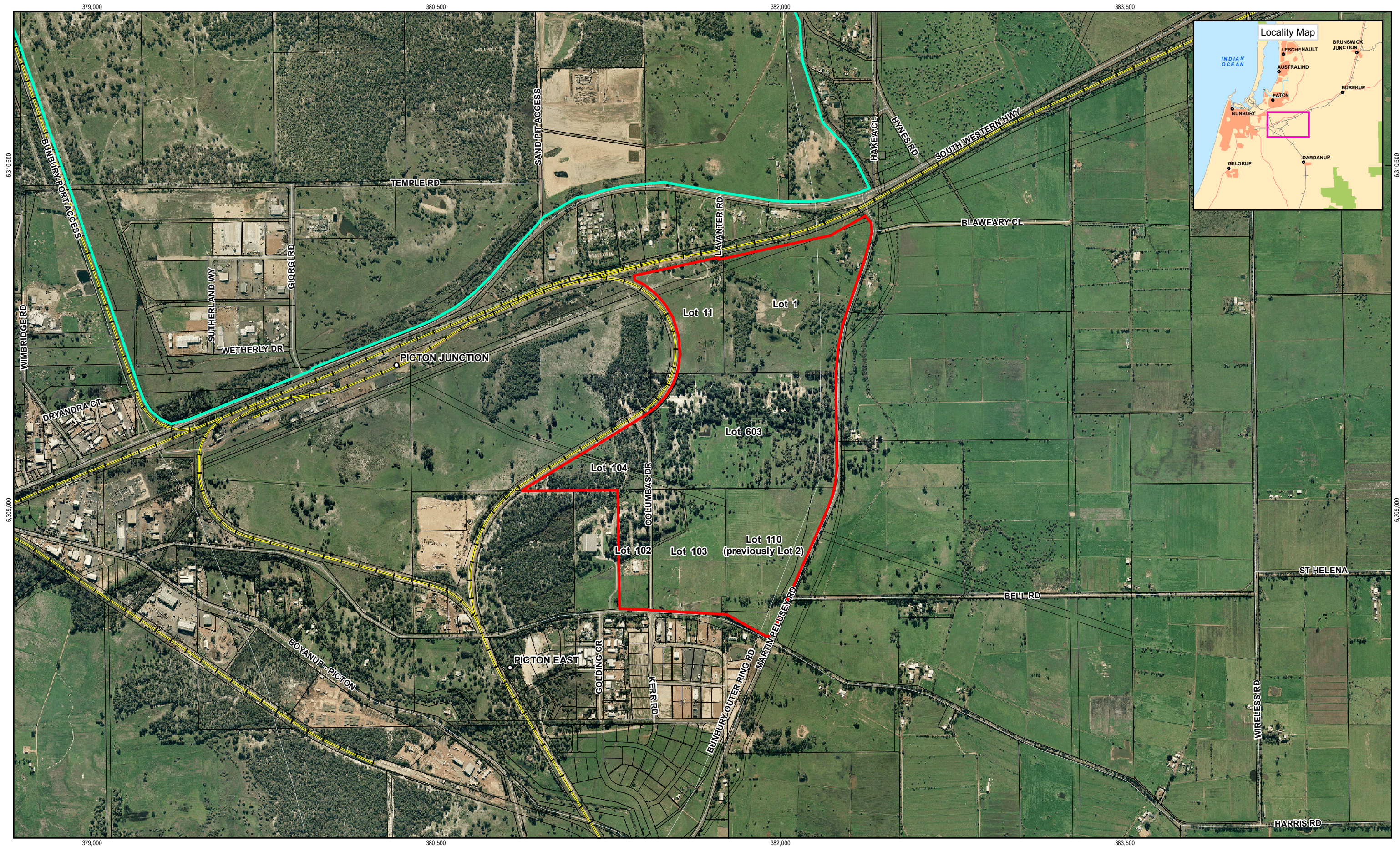
Opportunities to enhance the environmental values as they exist in the Picton South, Eastern Precinct include:

- ▶ Wide road verges in order to establish vegetation corridors that will enable fauna movement from Lot 1 to Lot 603;
- ▶ The use of local provenance where possible, to maintain the genetic diversity of the local flora species;
- ▶ Protecting remnant vegetations from incompatible landuses such as grazing and unrestricted access. This will allow the gradual restoration of the remnant, including the understorey.

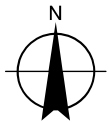


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Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50



LEGEND

- Place Names
- Railway
- Roads
- ▭ Site Boundary
- ▭ Preston Industrial Park: Northern Precinct



CLIENTS | PEOPLE | PERFORMANCE

Picton South
(Eastern Precinct)

Site Location

Job Number	61-26162
Revision	0
Date	29 NOV 2010

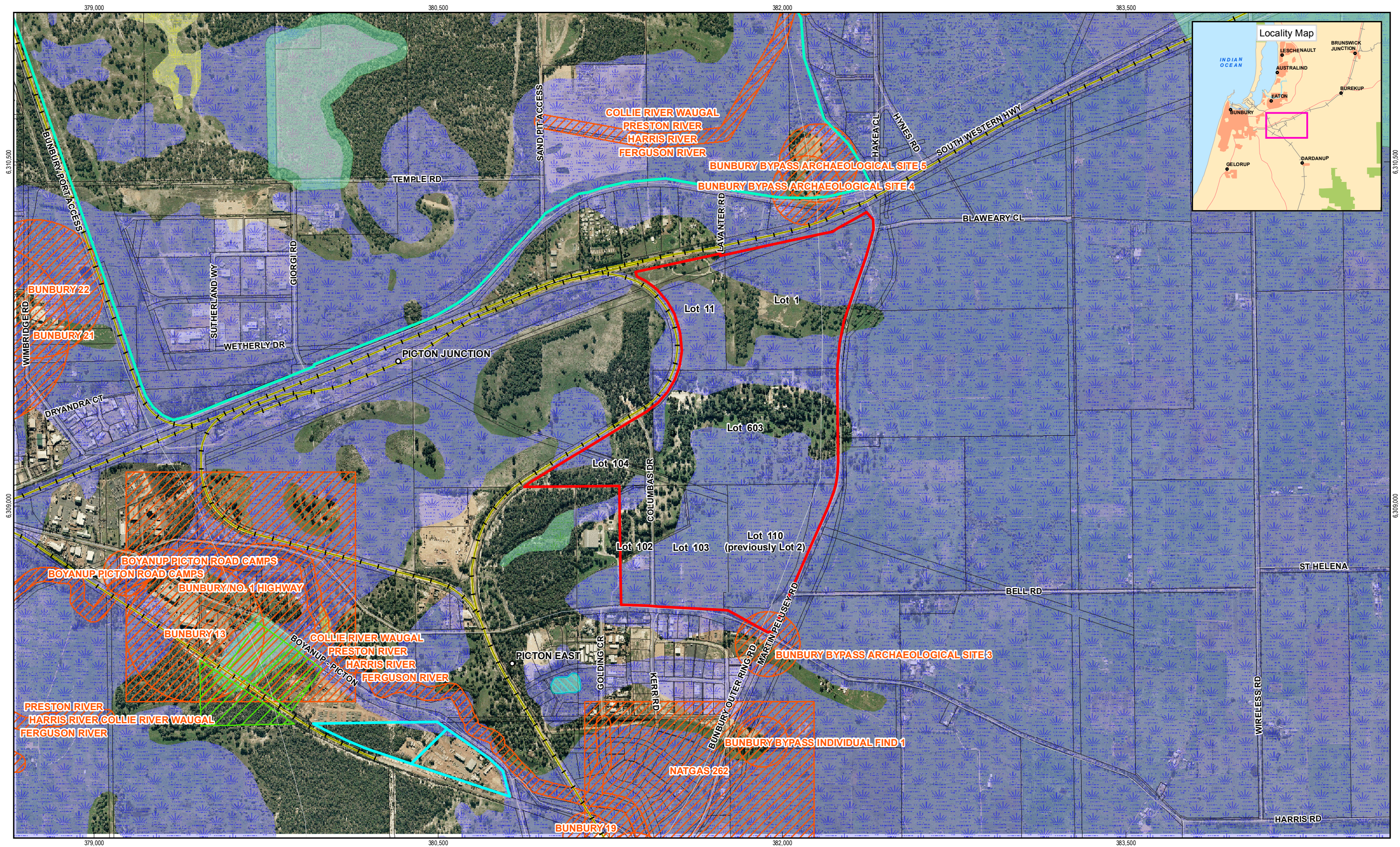
Figure 1

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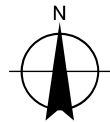


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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50



LEGEND

- Place Names
- Railway
- Roads
- Site Boundary
- Preston Industrial Park: Northern Precinct

Environmental Constraints

- ▨ Aboriginal Heritage Sites
- ▨ DEC Estate
- ▨ Environmentally Sensitive Areas
- ▨ EPP Lakes

Geomorphic Wetlands - Swan Coastal Plain

- ▨ Conservation
- ▨ Resource Enhancement
- ▨ Multiple Use
- ▨ Not Assessed



CLIENTS | PEOPLE | PERFORMANCE

Picton South
(Eastern Precinct)

Job Number	61-26162
Revision	0
Date	29 NOV 2010

Environmental Constraints

Figure 2

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Data Source: GA: NatMap Geodata Topo 250K Series 3 - 2006; Landgate: Bunbury 2031 Jan 2008 Mosaic - 20101027, Cadastre (LGATE-082) - 20101119, Roads (LGATE-012) - 20101027, Railway (LGATE036) - 20101119; GHD: Preston Industrial Park Boundary - 20091208, Site Boundary - 20101119; Landgate: Aboriginal Heritage Sites (DIA-003) - 20100118, EPP Lakes (1992) - Swan Coastal Plain - 20101027, Geomorphic Wetlands (DEC-004) - 200809, DEC Estate (DEC-007) - 200904, Environmentally Sensitive Areas (DEC-038) - 20101027. Created by: nnikmohdkamil, slee2

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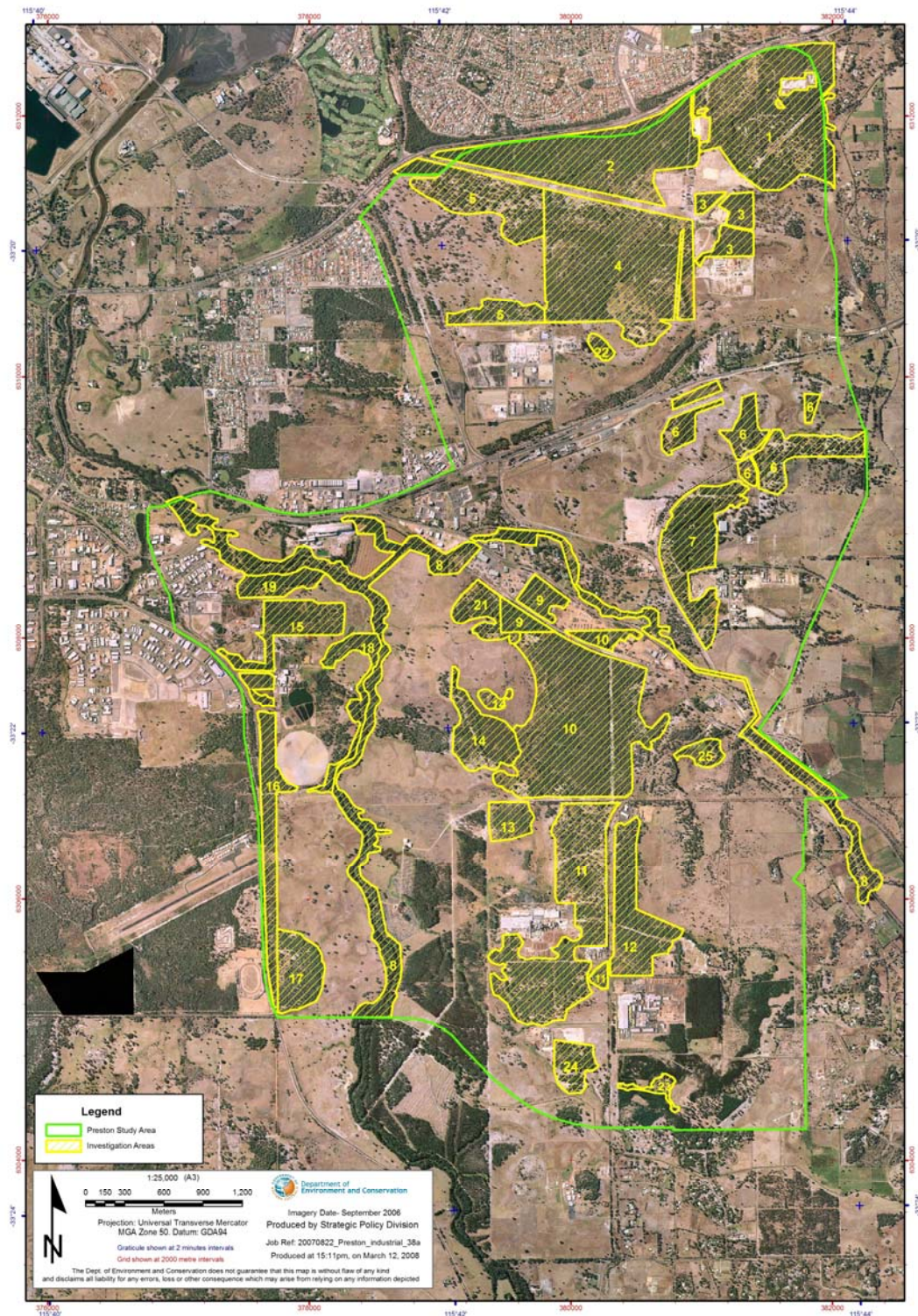


Figure .3 Investigation Areas

Figure 3. Vegetation Units within the Study Area

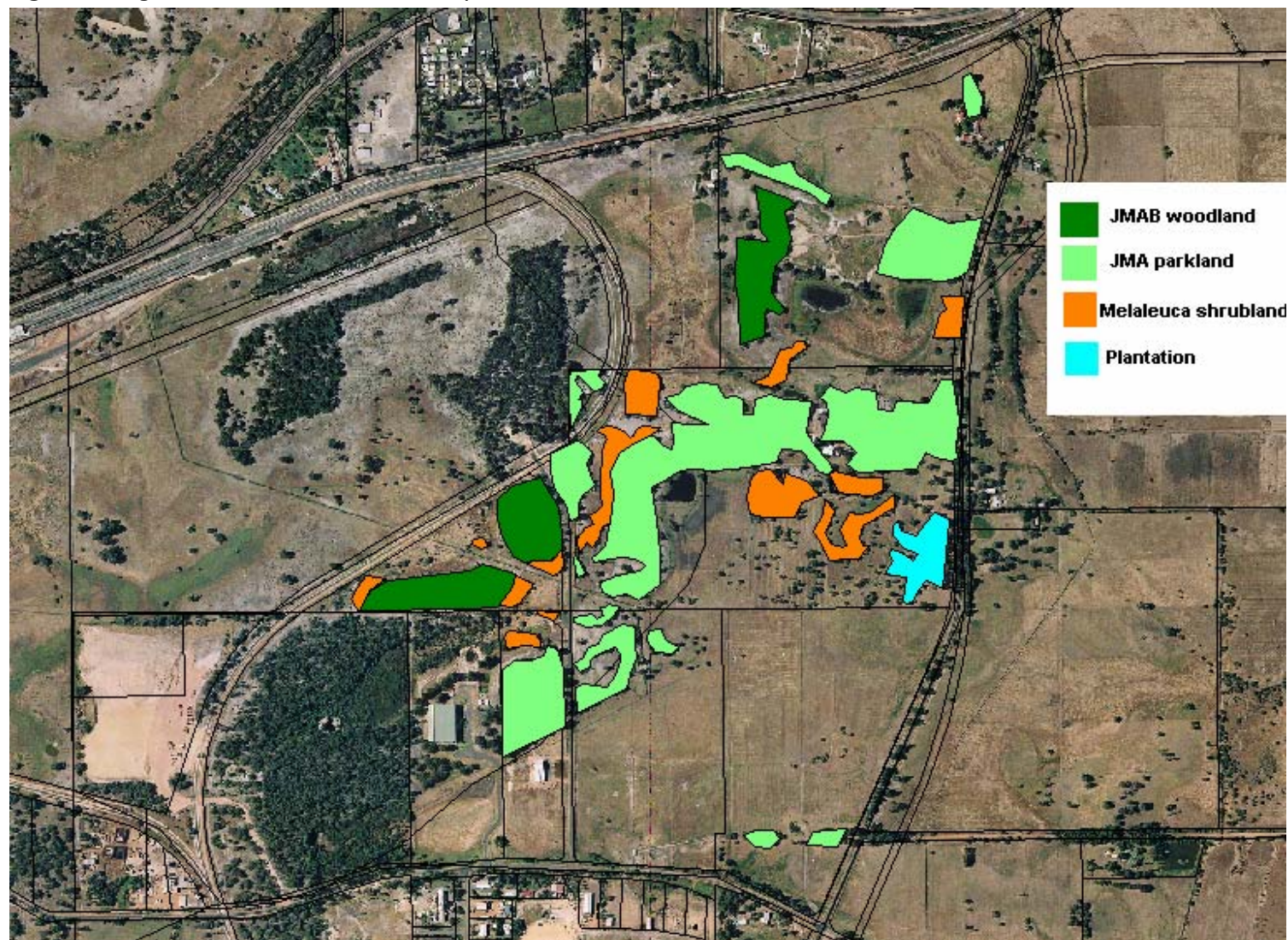
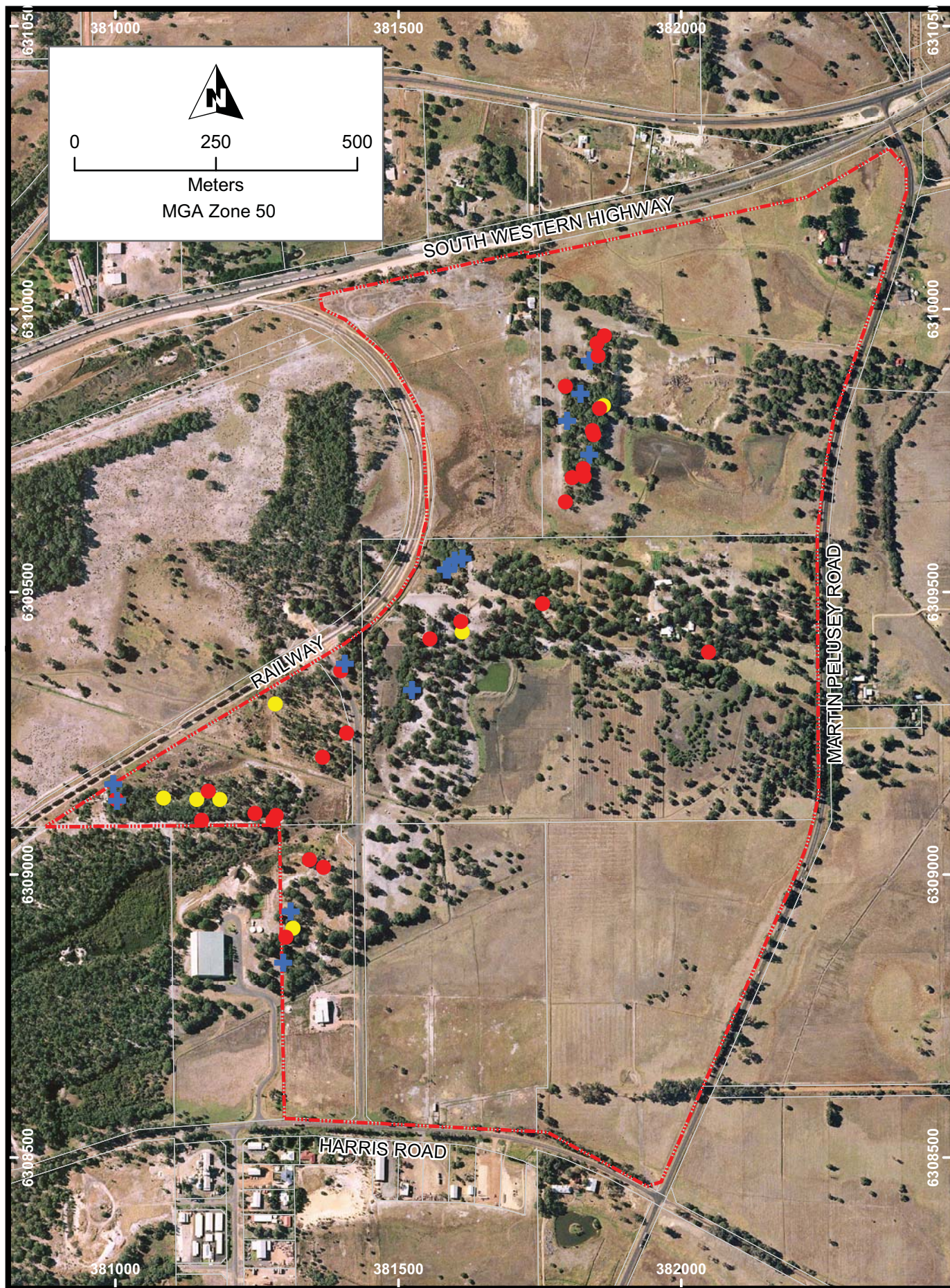
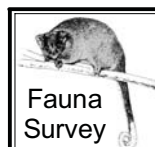


Figure 4. Vegetation Condition (*Ekologica 2009*)



Legend

- | | | | |
|---|----------------------|---|---------------------------------|
|  | Cadastral Boundaries |  | Habitat Tree with Small Hollows |
|  | Study area |  | Habitat Tree with Large Hollows |
| | |  | WRP Drey |



Fauna
Survey

DRAWN: G Harewood

DATE: Oct 2009

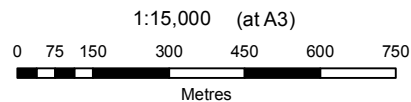
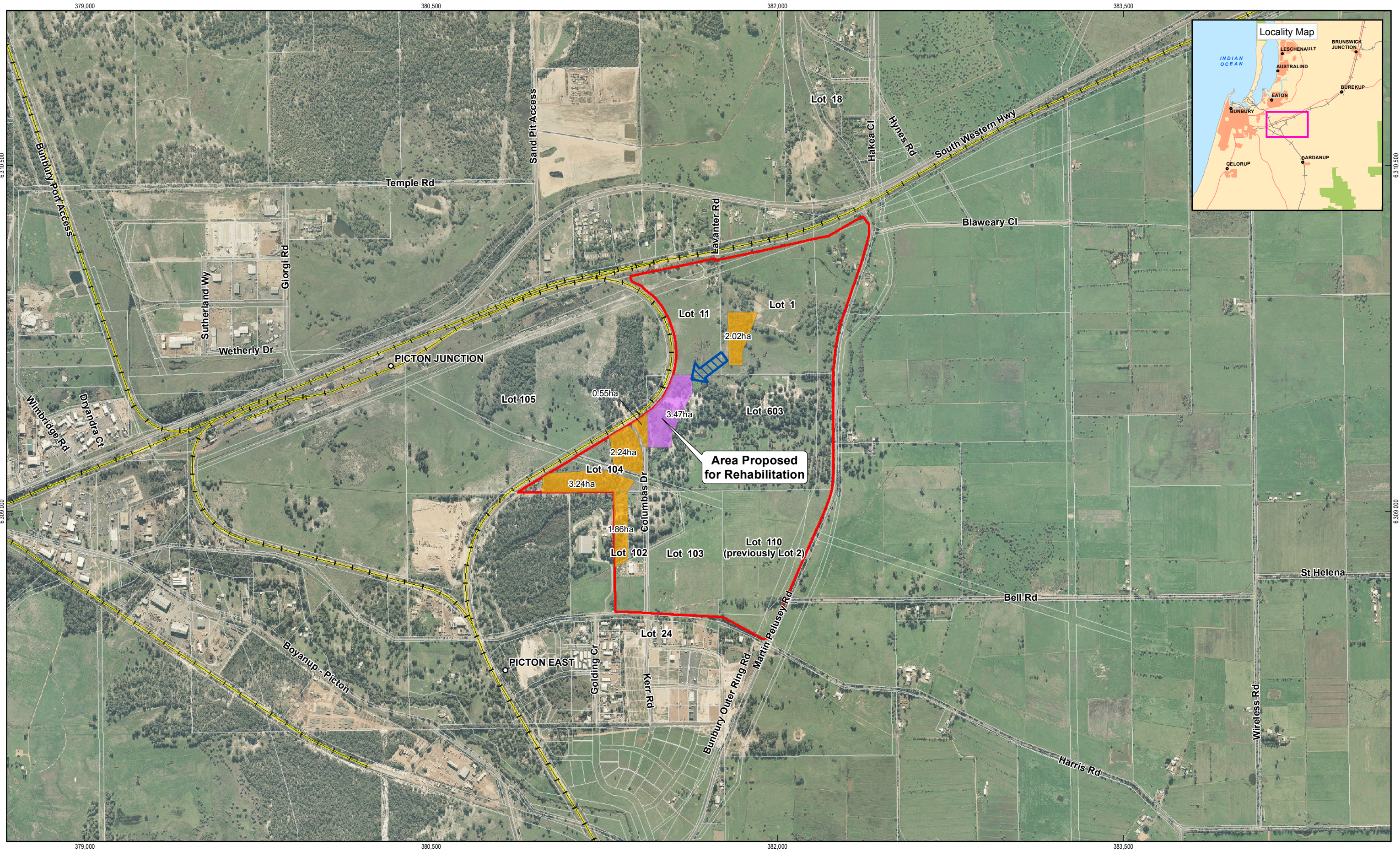
SCALE: 1: 10,000

Picton East

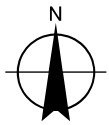
Habitat Trees & WRP Dreys

Figure: 4

Figure 5 Observed Fauna (Harewood 2009)



Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 50



LEGEND

- Place Names
- Railways
- Roads
- Cadastral
- Site Boundary

Environmental Protection Types

- Ecological Linkage
- Rehabilitation Area (3.47 Ha)
- Retained Area (9.92 Ha)



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Picton South
(Eastern Precinct)

Potential Environmental Protection and Rehabilitation Areas

Job Number 61-26162
Revision 3
Date 28 FEB 2010

Figure 6



Appendix A

Level 1 Flora and Vegetation Survey



Date: 22nd December 2009

Report on a Level 1 flora
and vegetation survey of
various lots at Picton East

Prepared for *Strategen*

By Russell Smith, *Ekologica Pty Ltd*
PO Box 207 Bunbury, WA, 6231

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A Level 1 flora survey (EPA, 2004) was carried out in October 2009 on approximately 33 ha of remnant vegetation in an area comprised of 7 lots (Lots 1, 2, 11, 103, 603, 102 and 104), totaling about 135 ha, in the proposed Picton East industrial park near Bunbury.	2
The remnant vegetation within the Study area has been classified as 1b or 1c by the South West Ecological Linkages project, which reflect the level of its proximity to a regional linkage axis line. The nearest edge of vegetation classed as 1b is up to 100 m from vegetation that touches or is less than 100 m from the axis line, and that classed as 1c is up to 100 m from vegetation classed as 1b.....	2
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SUMMARY

A Level 1 flora survey (EPA, 2004) was carried out in October 2009 on approximately 33 ha of remnant vegetation in an area comprised of 7 lots (Lots 1, 2, 11, 103, 603, 102 and 104), totaling about 135 ha, in the proposed Picton East industrial park near Bunbury.

A total of 46 species of native flora was found within the remnant vegetation of the Study area, which is a very low number reflecting the long history of agriculture in the area. No Declared Rare or Priority List flora, or other flora of conservation significance was found. The remnant vegetation of the Study Area was mapped as four units, one of these consisting predominantly of planted species. The vegetation units were similar to units previously derived for the Study Area.

Vegetation condition was predominantly “Completely Degraded” (79%) with 9% (3 ha) in “Degraded” condition and only 12% (4 ha) in “Good” condition.

The remnant vegetation within the Study area has been classified as 1b or 1c by the South West Ecological Linkages project, which reflect the level of its proximity to a regional linkage axis line. The nearest edge of vegetation classed as 1b is up to 100 m from vegetation that touches or is less than 100 m from the axis line, and that classed as 1c is up to 100 m from vegetation classed as 1b.

INTRODUCTION

1.1. Background

A Level 1 Flora Survey¹ was conducted on an area of land, comprised of 7 lots (Lots 1, 2, 11, 103, 603, 102 and 104), totaling about 135 ha, of which about 33 ha consists of remnant vegetation in the proposed Picton East industrial park. The survey was carried out between 19th and X October 2009. The Study Area is within the area identified by the Western Australian Planning Commission (WAPC) for the future development of the Preston Industrial Park (Environmental Protection Authority, 2008).

1.2. Regional Setting and Soils

The study area lies 9 km ESE of the Bunbury CBD adjacent to the South West Highway. It lies near the junction of the Pinjarra and Bassendean soil landscape zones (Schoknecht *et al*, 2004). To the east lie the relatively fertile soils of the Pinjarra Plain System and to the west the leached, infertile soils of the Bassendean Dune System (Seddon, 1972, Bolland, 1998).

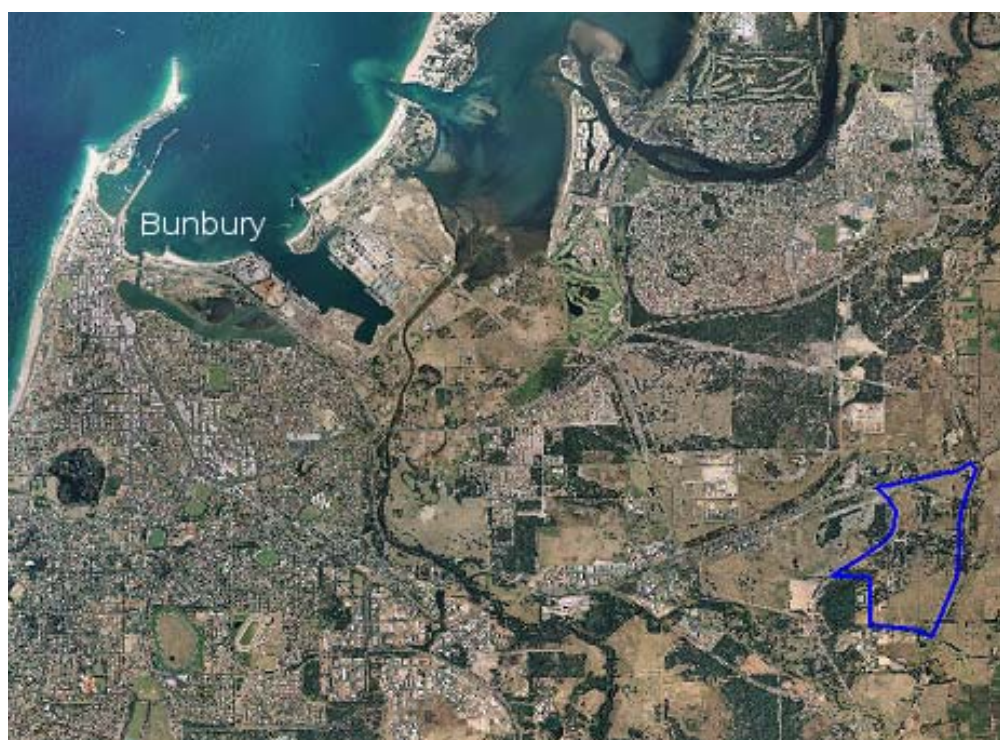


Figure 1. The Study Area in relation to the city of Bunbury.

¹ EPA (2004). Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. Guidance for the Assessment of Environmental Factors, No. 51. Environmental Protection Authority of Western Australia.

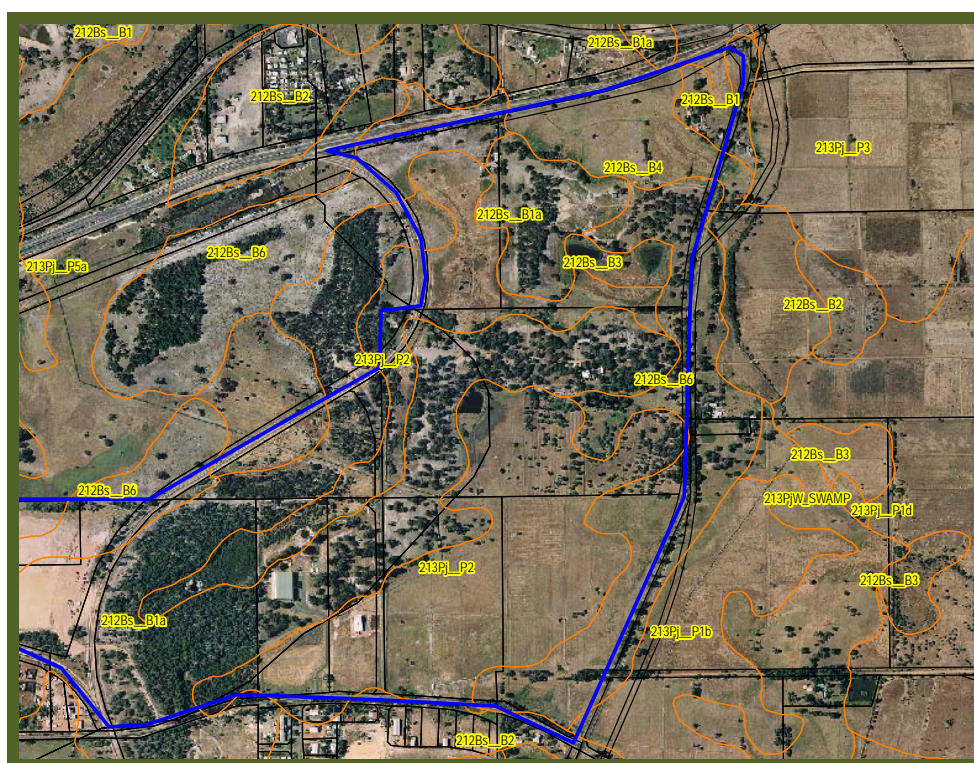


Figure 2. The soil mapping units of the Study Area.

Within the Study Area the soils are a mixture of Bassendean Dune and Pinjarra Plain soils (Fig. 2) with Bassendean soils generally occupying the low sandy ridges and the Pinjarra soils being found in the shallow depressions, or swales. The soil mapping units found within the Study Area are described in Table 1. Most of the remnant vegetation remaining within the Study Area is situated on the Bassendean soils, with the more fertile Pinjarra soils having been long ago cleared for agriculture.

1.3. *Vegetation and Threatened Ecological Communities*

1.3.1. Vegetation of the Study Area

The vegetation and flora of the Study Area has been investigated as part of a number of studies done as part of those carried out for the Preston Industrial Park (see references in EPA, 2008). Vegetation mapping by Smith (1974) at 1:250,000 scale shows the vegetation of the Study Area as: “Medium woodland; jarrah, marri & wandoo” occurring in the Pinjarra vegetation system of Beard (1981) and “Mosaic: Medium forest; jarrah-marri / Low woodland; *Banksia* / Low forest; teatree (*Melaleuca* spp.)” for the Bassendean System (corresponding with the Pinjarra Plain and Bassendean Dune soils respectively). Heddle *et al.* (1980) mapped the vegetation complexes of the System 6 area, which includes the Study Area. Two of these occur within the Study Area, these being:

Southern River Vegetation Complex: Open woodland of *E. calophylla* - *E. marginata* - *Banksia* species with fringing woodland of *E. rudis* - *M. raphiophylla* along creek beds.

Guildford Vegetation Complex: A mixture of open forest to tall open forest of *Corymbia calophylla* – *Eucalyptus wandoo* – *Eucalyptus marginata* and woodland of *Eucalyptus wandoo*. Minor components include *Eucalyptus rudis* – *Melaleuca raphiophylla*

Perth Bioplan mapping (unpublished) and Connell, Wagner and Ecoscape (2007) mapping of the vegetation within the Preston Industrial Park cited by EPA (2008) has not been sighted for this study.

Soil Mapping Unit	Mapping Unit Name	Description
Pj__P2	Pinjarra P2 phase	Flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam over clay.
Bs__B1	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m.
Bs__B1a	Bassendean B1a phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface.
Bs__B3	Bassendean B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.
Bs__B4	Bassendean B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.
Bs__B6	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.

Table 1. The soil mapping units found within the Study Area (From Barnesby, B.A. and Proulx-Nixon, M.E., 2000).

1.3.2. Threatened Ecological Communities

An ecological community is a naturally occurring biological assemblage that occurs in a particular type of habitat. The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified (DEC, 2007a).

A threatened ecological community (TEC) is one which is found to fit into one of the following categories; “presumed totally destroyed”, “critically endangered”, “endangered” or “vulnerable”.

Possible threatened ecological communities that do not meet survey criteria are added to DEC’s Priority Ecological Community Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. The threatened ecological communities of the Swan Coastal Plain mainly derive from the survey of Gibson *et al.* (1994).

There are several Threatened (TECs) known to occur within a 10 km radius of the study area. These are listed in Table 2.

Soil-landscape system	Threatened Ecological Community Type and Name (from Gibson <i>et al.</i> , 1994)	Status ²
Pinjarra	SCP3c “ <i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands, Swan Coastal Plain”	CR
Pinjarra	SCP08 “Herb rich shrublands in clay pans, Swan Coastal Plain”	VU
Pinjarra/Bassendean	SCP09 “Dense shrublands on clay flats, Swan Coastal Plain”	VU
Spearwood	SCP019 Shrublands on calcareous silts of the Swan Coastal Plain	CR*

Table 2. Threatened Ecological Communities occurring within 10 km of the Study Area at Picton East. (*: recommended to be upgraded from “VU”).

Priority Ecological Communities that occur within 10 km of the Study area include “Low lying *Banksia attenuata* woodlands or shrublands” (‘floristic community type SCP21c’) and “Southern *Banksia attenuata* woodlands (‘floristic community type SCP21b’)”, both of which are classified as Priority 3.

No Threatened Ecological Communities are known to occur within the Preston Industrial Park Area (which includes the Study Area) (EPA, 2008). However, the EPA report did acknowledge that vegetation is considered to be of regional significance at vegetation complex level. Of the four vegetation complexes within the Preston Industrial Park, the Guildford vegetation complex (Hedde *et al.*, 1980) is considered of highest conservation significance because it falls below the 10% target for retention.

Vegetation of the Southern River Complex, which is characterized by being in the transition between the Pinjarra Plain and the Bassendean Dunes, and which supports communities associated with the Bassendean Dunes but contains pockets of alluvial and colluvial soils which support plant communities characteristic of the Pinjarra Plain is also below the EPA’s target

² VU = “Vulnerable”, EN = “Endangered”, CR = “Critically endangered”.

level of native vegetation retention of at least 30% of the pre-clearing extent of the ecological communities on the Swan Coastal Plain.

1.3.3. Declared Rare and Priority Flora

Species of flora and fauna are defined as Declared Rare or Priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Environment and Conservation recognizes these threats of extinction and consequently applies regulations towards population and species protection. Declared Rare Flora species are gazetted under subsection 2 of section 23F of the Wildlife Conservation Act (1950) and therefore it is an offence to “take” or damage rare flora without Ministerial approval. Section 23F of the Wildlife Conservation Act (1950-1980) defines “to take” as “... to gather, pick, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority Flora are under consideration for declaration as ‘rare flora’, but are in urgent need of further survey (Priority One to Three) or require monitoring every 5-10 years (Priority Four). Table 3 presents the definitions of Declared Rare and the four Priority ratings under the Wildlife Conservation Act (1950) as extracted from Atkins (2008) and Department of Environment and Conservation (DEC 2009b, 2009c). Threatened or Priority flora occurring within 10 km of the Study Area are listed in Table 4.

2. OBJECTIVES

The objectives of the flora and vegetation survey for the study area were to:

- conduct an assessment of flora and vegetation values within the study area, building on existing studies in the adjacent area;
- conduct a review of other literature to summarize the values of flora and vegetation significance in the project area;
- review the documented flora and vegetation of significance, based on DEC records (databases);
- conduct a field assessment to:
 - identify the vascular flora species present;
 - determine the presence or absence of Declared Rare Flora (DRF), Priority or Significant Species;
 - define and spatially map vegetation communities;
 - define and spatially map vegetation condition;
- prepare a report that summarizes the findings of the desktop and field assessments

Conservation Code	Category
R	"Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such."
P1	"Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey."
P2	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey."
P3	"Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (ie. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora', but are in need of further survey."
P4	"Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years."

Table 3. Definitions of declared rare and priority list flora

Species	Priority
<i>Acacia flagelliformis</i>	4
<i>Anthotium junciforme</i>	4
<i>Aponogeton hexatepalus</i>	4
<i>Caladenia speciosa</i>	4
<i>Carex tereticaulis</i>	1
<i>Chamaescilla gibsonii</i>	3
<i>Diuris drummondii</i>	DRF
<i>Lasiopetalum membranaceum</i>	3
<i>Pultenaea skinneri</i>	4
<i>Rhodanthe pyrethrum</i>	3
<i>Schoenus capillifolius</i>	3
<i>Trichocline</i> sp. Treeton (B.J. Keighery & N. Gibson 564)	2
<i>Verticordia attenuata</i>	3
<i>Villarsia submersa</i>	4

Table 4. Declared rare and Priority List flora occurring with the Preston Industrial Park (EPA, 2008) or known to occur with 5 km of the Study Area (DEC, 2009b)

3. METHODS

The areas of remnant vegetation within the Study Area were traversed on foot on 19th and 20th October 2009. At representative locations a listing of all native vascular flora was made within an approximately 20 m radius. Notes were also taken of surface soil type, and vegetation condition using the method of Keighery (1994) (Table 5).

SCORE	DESCRIPTION
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as “parkland cleared” with the flora comprising weed or crop species with isolated native trees or shrubs.

Table 5. The native vegetation condition rating scale of Keighery (1994).

4. RESULTS AND DISCUSSION

4.1. Flora

Only 44 species of native flora were recorded from within the Study Area (Appendix A). Non-native species were generally not recorded, these having been comprehensively covered in previous surveys within the Preston Industrial Park Area (see references in EPA, 2008). This number of native species is far lower than would be expected in 33 ha of the original vegetation. No Declared Rare or Priority List flora, or other flora of conservation significance was found.

4.2. Vegetation units

Four vegetation units were identified within the Study Area (Table 6; Figure 3; Appendix B), however one of these, Vegetation Unit 4, is predominantly comprised of planted non-local species. There was sufficient variation in the other vegetation units to suggest that originally others may have been identifiable, however, loss of species has simplified the composition to the extent that only three are now recognizable. This accords with the survey carried out by the DEC (2007) and reported in EPA (2008), which identified three vegetation units within Investigation Area 6 (contained within the present Study Area). While they are described somewhat differently, the DEC (2007) vegetation units correspond closely with vegetation Units identified by this survey.

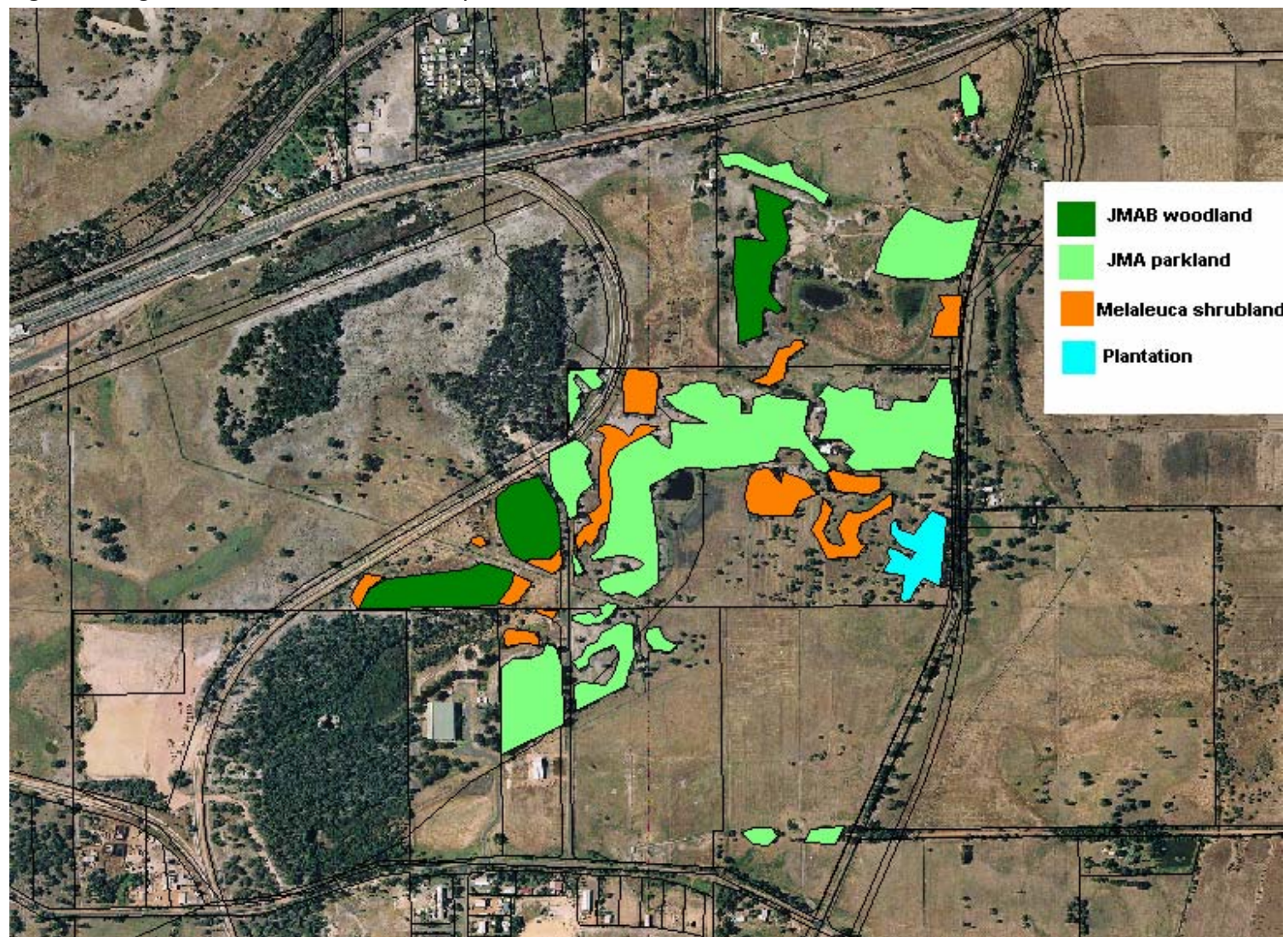
Species occurring within each of the vegetation Units are listed in Appendix 1. It is difficult because of their present paucity of native species to reliably assign the vegetation units identified in this study to the floristic community types described by Gibson *et al.* (1994) in the “Floristic Survey of the Swan Coastal Plain”, except for Vegetation Unit 1, which probably belongs to the “Central *Banksia attenuata*-*Eucalyptus marginata* woodlands” (SCP 21a) floristic community type. None of the vegetation units corresponds with any Threatened or Priority Ecological Community.

As can be seen from Table 6 Vegetation Units 1 and 2 occur within areas mapped as “Southern River complex” by Heddle *et al.* (1980) and Vegetation Unit 2 within areas mapped as “Southern River Complex” or “Guildford Complex”.

Unit Number	Vegetation Unit	Description	Vegetation Complex (Heddle <i>et al.</i> , 1980)
1	JMAB woodland	Woodland of Jarrah and Marri over low woodland of <i>Agonis flexuosa</i> , <i>Banksia attenuata</i> and <i>Banksia ilicifolia</i> woodland over shrubland	Southern River
2	<i>Melaleuca</i> woodland/ shrubland	Woodland or tall shrubland of <i>Melaleuca raphiophylla</i> or <i>M. preissiana</i> over a shrubland of <i>M. lateritia</i> and/or <i>M. teretifolia</i>	Southern River/Guildford
3	JMA parkland	Woodland to open woodland of Jarrah, Marri and <i>Agonis flexuosa</i> over pasture species and weeds	Southern River
4	Plantation	Mixed plantings of eucalypts and other species with scattered original tree species.	[Guildford]

Table 6. Vegetation Units identified within the Study Area described using the structural categories of Specht (1970).

Figure 3. Vegetation Units within the Study Area



4.3. *Vegetation Condition*

Because of a long history of grazing as well as partial clearing and the application of fertilizers most of the native species (particularly shrub and herbaceous species) within the remnant vegetation of the Study Area have been replaced by pasture species and annual and perennial weeds associated with agriculture. This is particularly so on the heavier and more fertile soils of the lower lying areas. Seventy nine percent (26 ha) of the remnant vegetation was judged to be in “Completely Degraded” condition, 9% (3 ha) in “Degraded” condition and only 12% (4 ha) in “Good” condition (Fig. 4).

4.4. *Significance of the vegetation*

Except for the area of Vegetation Unit 1 given a condition rating of “Fair to Good” the remnant vegetation of the Study Area has a low level of integrity in terms of the proportion of the original species remaining. This is particularly the case with regard to Vegetation Unit 3, which consists almost entirely of woodland or open woodland of jarrah, marri and *Agonis flexuosa* over an annual herbaceous understorey of pasture species. However, the many large trees, some with hollows, represent roosting and feeding resources for bird species. The EPA (2008) has assessed the vegetation within the Study Area as regionally significant because of the potential for used by the red-tailed Black Cockatoo, a Schedule 1 species and because the remnant vegetation represents degraded examples of the “Southern River” and “Guildford” vegetation complexes which have only 20% and 5% respectively of their original area remaining on the Swan Coastal Plain (EPA, 2008).

However, the vegetation in those areas mapped as Guildford in the Study Area (the *Melaleuca* shrubland community) has few of its original species left and has been assessed as completely degraded. Floristically it has little value as a representative of the Guildford Complex. There may be, however, opportunities to construct a partially rehabilitated linkage using remnants of this vegetation in the Study Area. This subject is addressed in Section 5, below.

4.5. *Linkages*

The South West Regional Linkages report (Molloy *et al.*, 2009) has identified some of the vegetation in the Study Area as belonging to 1b “proximity value” (in the south west part of Lot 104) and the rest as belonging to 1c. The meanings of these proximity values are;

- 1b, the vegetation is a patch with an edge touching or <100m from a natural area selected in 1a
- 1c, a patch with an edge touching or <100m from a natural area selected in 1b.

Vegetation classified as 1a is a patch with an edge touching or <100m from a linkage, ecological linkages being;

“a series of (both contiguous and non-contiguous) patches which, by virtue of their proximity to each other, act as stepping stones of habitat which facilitate the maintenance of ecological processes and the movement of organisms within, and across, a landscape”.

The report by Molloy *et al.* (2009) states that “In applying proximity analysis to land use planning it must be understood that 1b and 1c [...] level patches are not part of the core linkage (1a level patches), therefore their value in maintaining a linkage’s ecological function will (generally) not be as great”.

5. Conclusions and recommendations

As mentioned above, there is less than 5% of the pre-European extent remaining of the Guildford vegetation complex and only 20% of the Southern River Complex. Therefore even though both of these vegetation complexes are currently in a degraded condition it is important to conserve as much as possible of these vegetation types and to take steps, where practicable, to restore areas of vegetation within both the vegetation complexes.

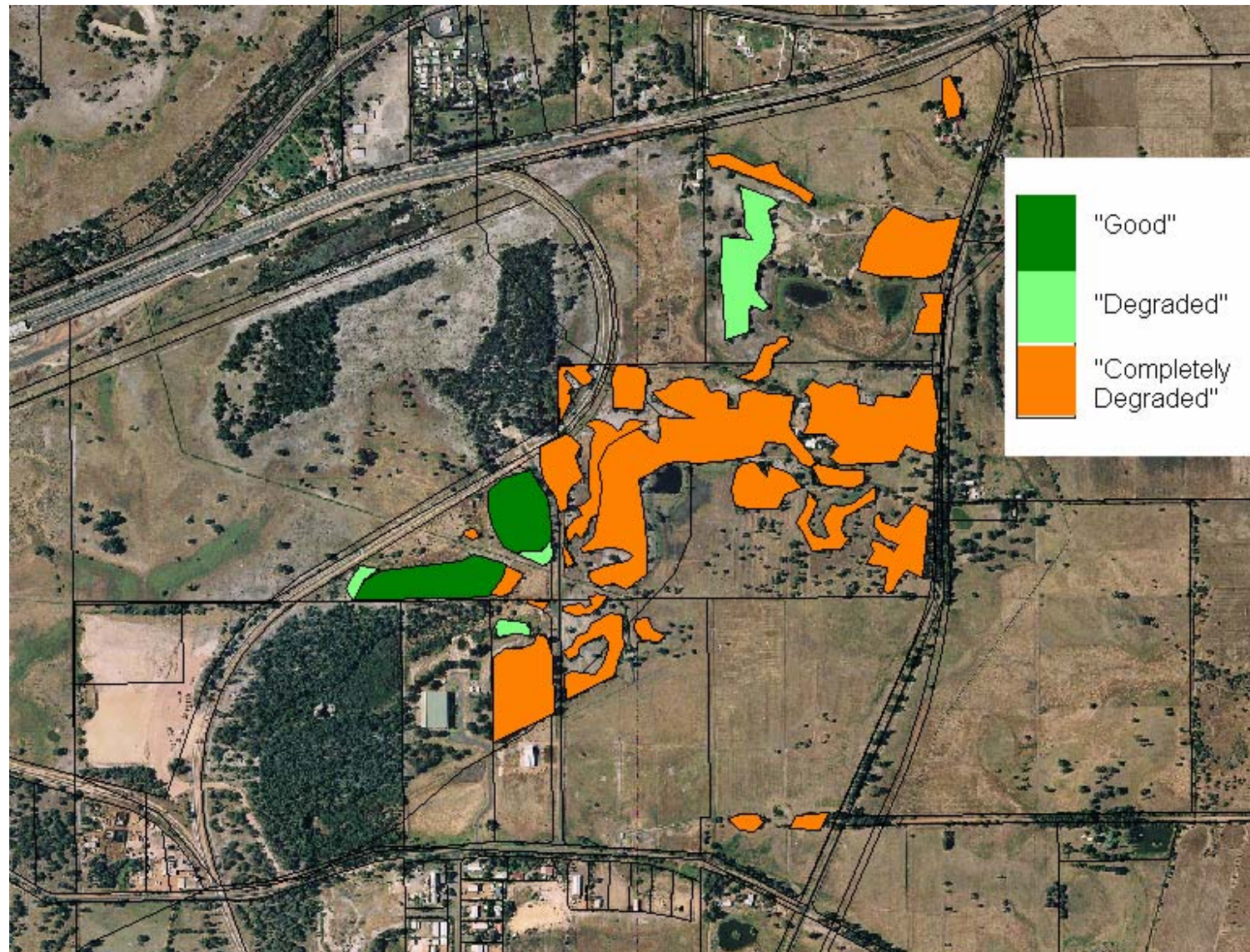
As the exact nature of any proposed development in the Study Area is unknown to the author at this juncture the following generalized recommendations are presented and should be incorporated into the planning process where possible.

Aim to reduce the impact on the existing remnant Flora much as possible. It is recommended that:

- Planning for development recognizes that some clearing of the remnant vegetation will occur however steps should be taken where possible, aim to retain and protect as much remnant vegetation on site. In particular the best quality woodland habitat as identified in EPA Bulletin 1282 (EPA 2008) should be a priority for protection (part recommendation Area E – Lot 104),
- Rehabilitated and Landscaped areas should be re-vegetated with local seed stock. The final selection of suitable species should be carried out after liaison with suitable qualified botanist with knowledge of both the Southern River and Guildford vegetation complex to ascertain which species are most suitable for the area,
- Any rehabilitation undertaken on the site should have regard to the vegetated corridors outlined in the GBRS and the recent recommendation from Malloy 2009,
- During site works areas requiring clearing should be clearly marked and access to other areas restricted to prevent accidental clearing of areas to be retained,
- All staff working on site should be made aware that native flora is highly susceptible to dieback disease caused by the soil-borne pathogen *Phytophthora cinnamomi* and

personnel working on the project should be instructed in dieback hygiene practices and a Dieback Management plan should be prepared for the site.

Figure 4. Vegetation condition within the Study Area using the method of Keighery (1994).



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Appendix A. List of locally native flora found within each vegetation unit in the Study Area at Picton East

FAMILY_NAME	LATIN NAME	1	2	3	4
Colchicaceae	<i>Burchardia congesta</i>	+			
Cyperaceae	<i>Gahnia trifida</i>		+		
	<i>Lepidosperma leptostachyum</i>	+			
	<i>Lepidosperma longitudinale</i>		+		
	<i>Lepidosperma squamatum</i>	+			
	<i>Mesomelaena tetragona</i>	+			
	<i>Tetraria octandra</i>	+			
Dasypogonaceae	<i>Dasypogon bromeliifolius</i>	+			
Dilleniaceae	<i>Hibbertia hypericoides</i>	+			
Droseraceae	<i>Drosera pallida</i>	+			
Epacridaceae	<i>Leucopogon conostephioides</i>	+			
	<i>Leucopogon propinquus</i>	+			
Haemodoraceae	<i>Conostylis aculeata</i>	+			
Hemerocallidaceae	<i>Thysanotus manglesianus</i>	+			
Iridaceae	<i>Patersonia occidentalis</i>	+			
Juncaceae	<i>Juncus pallidus</i>		+		
Lauraceae	<i>Cassytha racemosa</i>		+		
Mimosaceae	<i>Acacia pulchella</i>	+			
Myrtaceae	<i>Agonis flexuosa</i>	+	+	+	
	<i>Corymbia calophylla</i>	+	+	+	+
	<i>Eucalyptus marginata</i>	+		+	+
	<i>Kunzea glabrescens</i>	+	+	+	
	<i>Melaleuca lateritia</i>		+		
	<i>Melaleuca preissiana</i>		+		+
	<i>Melaleuca raphiophylla</i>		+		
	<i>Melaleuca teretifolia</i>		+		
Orchidaceae	<i>Microtis media</i>	+			
	<i>Thelymitra crinita</i>	+			
Papilionaceae	<i>Daviesia incrassata</i>	+			
	<i>Daviesia physodes</i>	+			
	<i>Hardenbergia comptoniana</i>	+			
	<i>Jacksonia furcellata</i>	+			
	<i>Kennedia prostrata</i>	+			
Proteaceae	<i>Banksia attenuata</i>	+			
	<i>Banksia dallanneyi</i>	+			
	<i>Banksia ilicifolia</i>	+			
	<i>Banksia littoralis</i>		+		
	<i>Xylomelum occidentale</i>	+		+	

FAMILY_NAME	LATIN NAME	1	2	3	4
Restionaceae	<i>Desmocladus fasciculatus</i>	+			
	<i>Hypolaena exsulca</i>	+			
	<i>Loxocarya cinerea</i>	+			
	<i>Meeboldina scariosa</i>		+		
Rubiaceae	<i>Opercularia hispidula</i>	+			
Xanthorrhoeaceae	<i>Xanthorrhoea brunonis</i>	+			
Number of native species		34	13	5	3

Appendix B: Photographs taken in the Vegetation Units identified in the Study Area

	<p>Vegetation Unit 1.</p> <p>Woodland of Jarrah and Marri over low woodland of <i>Agonis flexuosa</i>, <i>Banksia attenuata</i> and <i>Banksia ilicifolia</i> woodland over shrubland</p>
	<p>Vegetation Unit 2.</p> <p>Woodland or tall shrubland of <i>Melaleuca raphiophylla</i> or <i>M. preissiana</i> over a shrubland of <i>M. lateritia</i> and <i>M. teretifolia</i></p>
	<p>Vegetation Unit 3.</p> <p>Woodland to open woodland of Jarrah, Marri and <i>Agonis flexuosa</i> over pasture species and weeds</p>

Note: Vegetation Unit 4, which is comprised mainly of planted species is not illustrated.



Appendix B

Terrestrial Fauna Survey

Terrestrial Fauna Survey

(Level 1)

of

Lots 1, 2, 11, 102-104 & 603

Picton (East)

December 2009

Version 1

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- PLATE 3: Open woodland of Jarrah and Marri over low open woodland of Peppermint over grassland – Lot 603.
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This fauna assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Greg Harewood ("the Author"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints. In accordance with the scope of services, the Author has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

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EXECUTIVE SUMMARY

This report details the results of a fauna assessment of Lots 1, 2, 11, 102-104 & 603 located in East Picton (the study area). The site is located about 9 km south east of the Bunbury CBD and has an area of approximately 145 ha, most of which is cleared/partly cleared farmland (Figures 1 & 2).

It is understood that the information obtained as part of the fauna assessment reported on here will be used, in conjunction with the other studies, to facilitate the controlled and guided development of the subject site with the principal aim of minimising environmental impacts.

The extent of the broadly defined fauna habitats within the study area are shown in Figure 3 with a description of each given below.

1. **Cleared pasture with widely scattered trees:** Totally cleared or partly cleared with significant areas of bare sand in addition to sparse groundcover dominated by a mixture of introduced pasture grasses, clovers, weeds. There are scattered small groves and individual emergent trees including Peppermint *Agonis flexuosa*, Jarrah *Eucalyptus marginata*, Marri *Corymbia calophylla* and Paperbark *Melaleuca* sp.
2. **Open Woodland to Low Open Woodland of Jarrah, Marri, Banksia and Peppermint over grassland, open shrubland and shrubland.** Variable densities of Jarrah, Marri, Banksia and Peppermint along with associated species such as *Nuytsia floribunda* and *Xylomelum occidentale*. Considerable variation in ground cover and understory density with some areas having little or no native groundcover due to grazing/fire and others have a relatively dense low shrubland to shrubland of native species.
3. **Open Woodland to Low Open Woodland of Jarrah, Marri, and Peppermint over grassland.** Variable densities of Jarrah, Marri, and Peppermint along with associated species such as *Nuytsia floribunda* and *Xylomelum occidentale*. Little or no native groundcover due to clearing and ongoing grazing.
4. **Low Open Woodland to tall shrubland of Melaleuca:** Associated with the low lying areas most of which are seasonally inundated/waterlogged during wetter months of the year. Dominant species include *Melaleuca raphiophylla*, *M. preissiana* and *M. teretifolia*.
5. **Planted Non-endemic Eucalypts:** Some areas have been planted with various non-endemic eucalypts.
6. **Dams/areas of seasonal inundation:** Several manmade dams have been dug to provide water for livestock. Considerable sections of the cleared pasture areas are also inundated during the wetter months of the year.

Plates 1 to 6 illustrate the nature of fauna habitats existing within the study area.

During the course of the opportunistic fauna assessment the location of “habitat” trees were noted. In total 34 habitat trees were observed. The location of each tree observed is shown in Figure 4. Seven of the trees recorded contained large hollows with entrances that appeared from ground level to be possibly of a size suitable for black cockatoos to enter.

The results of the opportunistic fauna survey are summarised in Table 1 and listed in Appendix C. A total of 45 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the study area during the reconnaissance surveys carried out on the 19th of October 2009.

In summary, six vertebrate fauna species of conservation significance (listed on state or federal threatened species lists or DEC priority species) were positively identified as utilising the study area for some purpose during the Level 1 reconnaissance survey, these being:

- *Calyptorhynchus baudinii* Baudin’s Cockatoo - S1 (WAWC Act), Vulnerable (EPBC Act)
Foraging evidence observed during the survey period (chewed Marri nuts and Banksia cones, grubbing on marri tree trunks). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.
- *Calyptorhynchus latirostris* Carnaby’s Cockatoo – S1 (WAWC Act), Endangered (EPBC Act)
Foraging evidence observed during survey period (chewed Marri nuts and Banksia cones). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.
- *Calyptorhynchus banksii naso* Forest Red-tailed Black Cockatoo – S1 (WAWC Act), Vulnerable (EPBC Act)
Three individuals were observed foraging during survey period. Other foraging evidence also observed (chewed Marri nuts). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.
- *Ardea alba* Great Egret – Migratory (EPBC Act)
Observed within a section of the flooded pasture during the survey period. Unlikely to breed on site. .
- *Merops ornatus* Rainbow Bee-eater – Migratory (EPBC Act)
Common seasonal visitor to south west. Observed foraging and roosting in the study area during the survey period. Possibly breeds in some sections of the study area.
- *Pseudocheirus occidentalis* Western Ringtail Possum - S1 (WAWC Act), Vulnerable (EPBC Act)
Appears to be present in low numbers in some sections of the study area. Evidence observed (dreys and scats) is possibly the result of transient

individuals temporality residing in the area as opposed to a viable resident population.

Four species of conservation significance may possibly utilise the study area for some purpose at times but their current status on site and/or in the general area is difficult to determine because they were not sighted during the survey period or evidence of use of the study area was not found. Note: Habitat for some species onsite, while considered possibly suitable, may be marginal in extent/quality and species listed below may only visit the area for short periods or as rare/uncommon vagrants:

- *Ardea ibis* Cattle Egret – Migratory (*EPBC Act*)
May visit flooded pasture areas during wetter months of year. Unlikely to breed on site.
- *Apus pacificus* Fork-tailed Swift – Migratory (*EPBC Act*)
Rare seasonal visitor. May forage in area but very unlikely to roost.
- *Falco peregrinus* Peregrine Falcon - S4
Study site may form part of larger home range.
- *Falsistrellus mackenziei* Western False Pipistrelle - P4 (DEC Priority Species)
Status in the area difficult to determine. May at least forage on site.

Of most significance is the presence on site of black cockatoo and Western Ringtail Possum habitat. Potential impacts on these species and/or their habitat will need to be addressed during the planning process and where reasonable and practical planning should aim to retain/protect and enhance habitat so that they can persist and/or continue to utilise the site. The conservation of as much vegetation as possible will simplify any referral or assessment process required under the *EPBC Act*. Where impacts cannot be avoided, every attempt to minimise impacts should be made. The recommendations made in section 7.2 are provided to facilitate this.

If the clearing of vegetation (including black cockatoo and WRP habitat) is unavoidable the DEWHA will typically request onsite mitigation through revegetation and retention of key habitat as part of the approval process. Currently a ratio of 4:1 is seen as a minimum requirement for offsetting cockatoo foraging habitat loss by way of plantings (i.e. 4ha for every 1ha lost). For WRPs the ratio is 3:1. Offsetting the loss of cockatoo breeding habitat by plantings is generally viewed by DEWHA as needing to be higher (in the region of 10:1).

The actual impact on fauna and fauna habitat and likely obligations under the *EPBC Act* should be re-assessed when development plans are finalised.

1. INTRODUCTION

This report details the results of a fauna assessment of Lots 1, 2, 11, 102-104 & 603 located in East Picton (the study area). The site is located about 9 km south east of the Bunbury CBD in south west Western Australia and is centred at approximately 33.347702°S and 115.729507°E (Figures 1 & 2). The study site has an area of approximately 145 ha most of which is cleared/partly cleared farmland.

2. DEVELOPMENT PROPOSAL

No final development proposal currently exists for the site. The fauna survey forms part of a series of investigations which will be used to assess environmental opportunities and constraints for that will be used for future planning and development at the site. It is understood that the information obtained as part of the fauna assessment reported on here will be used, in conjunction with the other studies, to facilitate the controlled and guided development of the subject site with the principal aim of minimising environmental impacts.

3. SCOPE OF WORKS

The scope of works is to conduct a “fauna survey”. To achieve this, the following will be carried out:

1. Level 1 Fauna Survey (to EPA standard) including targeted searches for evidence of Western Ringtail Possums (WRP) and Black Cockatoo foraging/nesting/roosting;
2. Significant Tree Survey (including potential black cockatoo nest hollows); and
3. Report summarising results with management/planning recommendations

This survey report has been prepared for use in the EPA's (Environmental Protection Authority's) Environmental Impact Assessment (EIA) process (if required) and is considered suitable for this purpose.

4. METHODOLOGY

4.1 FAUNA INVENTORY

4.1.1 Potential Fauna

A list of all vertebrate fauna potentially occurring within the study area was compiled from searches the Department of Environment and Conservation's (DEC's) Threatened Fauna and 'NatureMap' database (joint DEC and Western Australian Museum (WAM) data), the Department of the Environment, Water, Heritage and the Arts (DEWHA) Commonwealth Environment Protection and Biodiversity Conservation database, Birds Australia's 'Birddata' database, published and unpublished reports and specialist books detailing fauna of the general area.

Taxonomy and nomenclature for fauna species used in this report generally follow Aplin and Smith (2001) for amphibians and reptiles, How *et al.* (2001) for mammals and Johnstone (2001) for birds. Some names, including common names recommended for national and international use by Christidis and Boles (1994) for birds, are also used. Common names for reptiles and amphibians come from a variety of sources and are not necessarily generally accepted. Sources include Van Dyk & Strahan (2008), Bush *et al* (2007), Wilson and Swan (2008), Bush *et al* (2002), Tyler *et al.* (2000) and Glauret (1961).

4.1.2 Fauna of Conservation Significance

The conservation significance of fauna species has been assessed using data from the following sources:

- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Administered by the Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA);
- *Western Australian Wildlife Conservation Act 1950 (WAWC Act)*. Administered by the Western Australian Department of Environment and Conservation (DEC);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and the
- DEC Priority Fauna list. A non-legislative list maintained by the DEC for management purposes.

The *EPBC Act* also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

(Note - Species listed under JAMBA are also protected under Schedule 3 of the *WAWC Act*.)

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The conservation status of all the vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the study area has been assessed using the most recent lists published in accordance with the above-mentioned Acts, International Agreements and DEC's priority fauna list. The status of each species as defined in the above mentioned acts is indicated in the fauna listings of this report. A full listing of conservation codes are held in Appendix A.

4.1.3 Other Species of Significance

A number of other species not listed in official lists can also be considered of regional conservation significance. These include species that have a restricted range, those that occur in breeding colonies and those at the limit of their range.

While not classified as rare, threatened or vulnerable under any State or Commonwealth legislation, a number of bird species have been listed as of significance on the Swan Coastal portion of the Perth Metropolitan Region (Bush Forever - Government of Western Australia 1998 and 2000). The bird species are often referred to as Bush Forever Decreaser Species. The three categories used for birds within the Bush Forever documents are:

- Habitat specialists with reduced distribution on the Swan Coastal Plain (code Bh)
- Wide ranging Species with reduced population's on the Swan Coastal Plain. (code Bp)
- Extinct in the Perth region (code Be)

The presence of Bush Forever species should be taken into consideration when determining an areas fauna values. Bush Forever decreaser species are indicated as such within the species list held in Appendix C.

4.2 SITE RECONNAISSANCE SURVEY

4.2.1 Opportunistic Fauna Observations

Opportunistic observations of fauna species was made during a 5 hour daytime survey of the site. This included a series of close spaced transects across the site while searching under logs, rocks, leaf litter and observations of bird species with binoculars.

As the area has the potential to be utilised by WRPs and/or black cockatoos additional effort was made to determine if these species are utilising the site and to what degree so that their potential presence can be taken into consideration for planning and management:

The targeted assessments were be carried out concurrent with the Level 1 survey and included:

- Specific observations to locate and record WRP dreys (and other potential daytime refuges), scats and individual WRPs;
- Specific observation of foraging and roosting evidence left by any of the three federally listed black cockatoos species; and
- Determination of the amount and quality of potential WRP and black cockatoo habitat on site.

No targeted WRP night time surveys were considered warranted at this stage. If the presence of the WRP is confirmed and the proposed development is likely to have some impact additional surveys may be required/requested by regulatory authorities as part of the approval process.

4.2.2 Fauna Habitat Assessment

A habitat assessment was carried out specifically targeting the likely habitats of listed (under the relevant Federal and State Acts) threatened vertebrate species potentially occurring in the study area. The aim of the habitat assessment was to determine if it was likely that any of the threatened species would be utilising the areas that will be impacted on as a consequence of the development proposal proceeding in its current form.

The initial phase of the assessment involved the review of available information on the habitats of the threatened species listed as possibly occurring in the area. During the field survey the habitat within the study area was assessed and specific elements searched for to determine the potential that any of the listed threatened species maybe utilising the area and its significance to them. In addition the habitat information obtained was used to aid in the compilation of a potential fauna list.

The vegetation communities present have been used as the basis for a classification into broad fauna habitats. In addition details on specific habitat components such as significant trees with hollows, loose bark, fallen hollow logs, and the amount of leaf litter were noted if present.

Quality of habitat with respect to WRPs and black cockatoos was specifically noted.

4.2.3 Habitat Tree Assessment

During the course of the opportunist and habitat assessment observations of “habitat” trees were recorded using a GPS. The aim of the survey was to document the presence of trees containing hollows suitable for fauna to use. For the purposes of this study a “habitat” tree “was defined as

“Generally any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) suitable for the occupation of hollow-dependent fauna as nesting, roosting and/or denning sites. Hollows that had an entrance greater than about 12cm in diameter and would allow the entry of a black cockatoo were recorded as a “potential cockatoo nest hollow”.

The assessment of hollows was conducted from ground level. Because it is impossible to determine all the characteristics of hollows that are favoured by fauna species, the assessment of suitability was based entirely on the size of each hollow’s entrance, though other factors such as orientation and position (relative to ground level) was also taken into consideration. The main aim of the habitat tree assessment was to determine if any trees on site contained hollows suitable for black cockatoos to use as nest hollows.

4.3 LOCAL CONSERVATION SIGNIFICANCE OF THE STUDY AREA

The local (sub-regional) significance of the study area has been determined by applying site specific criteria such as:

- Fauna species and/or habitat present that is poorly represented in the general study area;
- Fauna habitat within the general study area supporting species of conservation or other significance;
- Fauna habitat in better condition than other similar locations in general study area.

4.4 VALUE OF THE STUDY AREA AS A WILDLIFE CORRIDOR

Corridors of native vegetation can be very important for the dispersal of species in otherwise cleared landscapes. Any areas of remnant vegetation making up

part of a linkage is therefore of great value by facilitating the movement of species that cannot utilise cleared/developed land. Linkage with adjacent bushland areas has been identified as a natural attribute of high priority in the assessment of an areas regional significance.

During the field survey and by examination of plans and air photos of the study area, the value of the site as a corridor/ecological linkage between any reserves, conservation areas or other significant areas of remnant bush was assessed.

5. SURVEY CONSTRAINTS

The assessment reported on here has included a desktop analysis and a site reconnaissance survey that included opportunistic fauna observations over a total of about eight hours. No seasonal sampling has been conducted.

Fauna species are indicated as potentially present within this report based on there being suitable (quality and extent) habitat within the study area. With respect to opportunistic observations, the possibility exists that certain species may not have been detected during field investigations due to:

- seasonal inactivity during field survey;
- species present within micro habitats not surveyed;
- cryptic species able to avoid detection;
- transient wide-ranging species not present during survey period.

The lack of observational data on some species should therefore not be taken as necessarily indicating that a species is absent from the site.

In recognition of survey limitations a precautionary approach has been adopted for this assessment. Any fauna species that would possibly occur within the study area as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the Author has been assumed to potentially occur in the study area.

Field survey work was carried out by Greg Harewood (B.Sc. Zoology) on the 19th October, 2009.

6. RESULTS

6.1 REGIONAL BIOLOGICAL CONTEXT

The project area is situated within the south west margin of the Swan Coastal Plain. The Swan Coastal Plain Bioregion (SWA) is classified as part of the

Interim Biogeographical Regionalisation for Australia. The SWA bioregion is described as being a:

“Low lying coastal plain mainly covered with Woodlands. It is dominated by Banksia or Tuart on sandy soils, Casuarina obesa on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah Woodland. Warm Mediterranean. Three phases of marine sand dune development provide relief.

The outwash plains, once dominated by Casuarina obesa – Marri Woodlands and Melaleuca shrublands, are extensive only in the south.” (Thackway and Cresswell, 1996; IBRA, 2000).

The study area lies within a section of the Bassendean Dunes System and the Guilford Formation. In this area the Bassendean Dunes consist of extremely low to very low relief dunes with, deep, bleached grey sands. The Guilford formation, represent by low lying areas within the study area consists of poorly drained flats with shallow pale sand to sandy loam over clay (Agmap 2003).

Broadscale mapping by Beard (Beard 1991) shows the general area, prior to disturbance, to have consisted of a mosaic of medium forest (Jarrah-Marri), low woodland (Banksia and Jarrah-Banksia) and Low forest (Melaleuca spp).

Vegetation complexes were defined in relation to landform and soil units for the Swan Coastal Plain by Heddle *et al.* (1980). A total of 15 vegetation complexes were described for the Greater Bunbury Region (GBR - WAPC 2000). Of these the Southern River Complex and the Guildford Complex are mapped as originally comprising the vegetation units present within the study area.

The Southern River Complex is described as being an open woodland of Marri *Corymbia calophylla*, Jarrah *Eucalyptus marginata* and *Banksia* species with fringing woodlands of Flooded Gum *Eucalyptus rudis* and Swamp Paperbark *Melaleuca raphiophylla* along creek beds.

The Guildford Complex is described as a mixture of open forest to tall open forest of Marri *Corymbia calophylla* – Wandoo *Eucalyptus wandoo* – Jarrah *Eucalyptus marginata* and woodlands of Wandoo *Eucalyptus wandoo*. Minor components include Flooded Gum *Eucalyptus rudis* and Swamp Paperbark *Melaleuca raphiophylla* (Heddle *et al.* 1980)

6.2 FAUNA HABITAT ASSESSMENT

6.2.1 Fauna Habitats

The broad scale fauna habitats within the study area are based on vegetation structure. The study area has been subject to a significant amount of historical disturbance such as extensive clearing, construction of fire breaks and access

tracks, construction of dams and ongoing livestock grazing. These impacts have reduced the sites overall value to fauna by reducing or altering habitat quality and biodiversity values to a significant degree.

The extent of the broadly defined fauna habitats within the study area are shown in Figure 3 with a description of each given below. Additional information of the vegetation units present within the study area can be found in the botanical report (ekologica 2009).

- 7. Cleared pasture with widely scattered trees:** Totally cleared or partly cleared with significant areas of bare sand in addition to sparse groundcover dominated by a mixture of introduced pasture grasses, clovers, weeds. There are scattered small groves and individual emergent trees including Peppermint *Agonis flexuosa*, Jarrah *Eucalyptus marginata*, Marri *Corymbia calophylla* and Paperbark *Melaleuca* sp.
- 8. Open Woodland to Low Open Woodland of Jarrah, Marri, Banksia and Peppermint over grassland, open shrubland and shrubland.** Variable densities of Jarrah, Marri, Banksia and Peppermint along with associated species such as *Nuytsia floribunda* and *Xylomelum occidentale*. Considerable variation in ground cover and understory density with some areas having little or no native groundcover due to grazing/fire and others have a relatively dense low shrubland to shrubland of native species.
- 9. Open Woodland to Low Open Woodland of Jarrah, Marri, and Peppermint over grassland.** Variable densities of Jarrah, Marri, and Peppermint along with associated species such as *Nuytsia floribunda* and *Xylomelum occidentale*. Little or no native groundcover due to clearing and ongoing grazing.
- 10. Low Open Woodland to tall shrubland of Melaleuca:** Associated with the low lying areas most of which are seasonally inundated/waterlogged during wetter months of the year. Dominant species include *Melaleuca raphiophylla*, *M. preissiana* and *M. teretifolia*.
- 11. Planted Non-endemic Eucalypts:** Some areas have been planted with various non-endemic eucalypts.
- 12. Dams/areas of seasonal inundation:** Several manmade dams have been dug to provide water for livestock. Considerable sections of the cleared pasture areas are also inundated during the wetter months of the year.

Plates 1 to 6 illustrate the nature of fauna habitats existing within the study area.

6.2.2 Habitat Tree Assessment

During the course of the opportunistic fauna assessment the location of “habitat” trees were noted. In total 34 habitat trees were observed. The location of each tree observed is shown in Figure 4. Seven of the trees recorded contained large hollows with entrances that appeared from ground level to be possibly of a size suitable for black cockatoos to enter.

Hollows are an important resource as many fauna species are obligated to utilise them for day to day refuge and as breeding sites. In this area of the south west, hollows have the potential to be used by a range of fauna including, but not limited to, the three Black Cockatoo species, Common Brushtail Possums, Brush-tailed Phascogales, Galahs, Regent Parrots, Australian Ringneck Parrots, Red-capped Parrots, Western Rosellas, Elegant Parrots, Boobook Owls, Australian Owlet-nightjars, Sacred Kingfishers, Striated Pardalotes and Tree Martins.

It should be noted that if the project is referred to the federal Department of Environment, Water, Heritage and the Arts (DEWHA) additional information on the habitat trees, in particular those that represent potential breeding habitat to black cockatoos maybe required to better define potential impacts of any proposed development. Currently the DEWHA regard a woodland stand (in this area Jarrah or Marri trees) of an area greater than 0.5ha and containing more than three trees with a diameter at breast height (DBH) of greater than 500mm as significant breeding habitat, irrespective of the presence or absence of any actual hollows suitable for black cockatoos to use.

6.3 FAUNA INVENTORY

6.3.1 Opportunistic Fauna Surveys

The results of the opportunistic fauna survey are summarised in Table 1 and listed in Appendix C. A total of 45 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the study area during the reconnaissance surveys carried out on the 19th of October 2009. Four introduced species were also observed (includes livestock).

Evidence of four listed threatened species was observed (all three species of black cockatoo – foraging evidence, Forest Red-tailed Black Cockatoo – three individuals observed, Western Ringtail Possum – scats and dreys). Two migratory species were observed (Rainbow Bee-eater and Great Egret). No evidence of DEC priority species was sighted.

6.3.2 Western Ringtail Possum Survey

Daytime observations for dreys, scats and WRPs were carried out as part of the opportunistic fauna survey conducted on the 19th October 2009.

The day time survey results are shown in Figure 4. In total fourteen dreys were found. WRPs will use hollows in preference to building dreys and therefore some of the 27 habitat trees identified also represent potential daytime refuge sites.

WRP scats were found to uncommon and difficult to find, suggesting the presence of a sparse, very low density population (Figure 5).

The results suggest that the species is present in low numbers in some sections of the study area. The evidence observed (dreys and scats) is possibly the results of transient individuals moving through the area as opposed to a viable resident population. Irrespective of current population levels substantial areas of the remnant vegetation on site must be regarded as potential habitat that may be considered important for recovery of the species in the long term by regulatory authorities.

6.3.3 Potential Fauna

Table 1 summarises the numbers of potential species based on vertebrate class considered likely to be present in the study area. A complete list of vertebrate fauna possibly inhabiting or frequenting the study area is held in Appendix C. The results of a DEC Threatened fauna database search and the *EPBC Act* database are held in Appendix D.

Details on specially protected and priority species expected and/or listed as potentially occurring in the general area are given in Table 2 and Appendix E.

Not all species listed in existing databases and publications as potentially occurring within the study area (i.e. *EPBC Act's* Threatened Fauna and Migratory species lists, DEC's Threatened Fauna Database and various publications) are shown in the expected listing in Appendix C. Some species have been excluded from this list based largely on the lack of suitable habitat at the study site (e.g. whales, offshore seabirds) and in the general area or known local extinction even if suitable habitat is present (e.g. Malleefowl).

Despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the site (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment.

Table 1: Summary of Potential Fauna Species (As listed in Appendix C)

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species	Number of species observed October 09
Amphibians	7	0	0	0	1
Reptiles	20	0	0	0	2
Birds	91 ⁵	4	4	0	39
Non-Volant Mammals	11 ⁸	1	0	0	7 ⁴
Volant Mammals (Bats)	8	0	0	1	0
Total	137 ¹³	5	4	1	49 ⁴

Superscript = number of introduced species included in total.

6.3.4 Fauna of Conservation Significance

A review of EPBC Act's threatened fauna list, DEC's Threatened Fauna Database and Priority List and scientific publications identified about 25 specially protected, priority or migratory fauna species as potentially occurring in the general vicinity of the study area. Most of those species that have no potential whatsoever, under normal circumstances, to utilise the site for any purpose are not listed or discussed despite appearing in the DEC or *EPBC Act* database searches (Appendix D). Species have been omitted from the potential list (Appendix C) for the site principally due to lack of suitable habitat on site or known local extinction. A brief account of these species with details on their distribution and habitat preference and potential impact are shown in Table 2. Additional details on significant species that potentially utilise the study site are given in Appendix E.

In summary, six vertebrate fauna species of conservation significance (listed on state or federal threatened species lists or DEC priority species) were positively identified as utilising the study area for some purpose during the Level 1 reconnaissance survey, these being:

- *Calyptrorhynchus baudinii* Baudin's Cockatoo - S1 (WAWC Act), Vulnerable (EPBC Act)
Foraging evidence observed during the survey period (chewed Marri nuts and Banksia cones, grubbing on marri tree trunks). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.

- *Calyptrorhynchus latirostris* Carnaby's Cockatoo – S1 (WAWC Act), Endangered (EPBC Act)
Foraging evidence observed during survey period (chewed Marri nuts and Banksia cones). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.
- *Calyptrorhynchus banksii naso* Forest Red-tailed Black Cockatoo – S1 (WAWC Act), Vulnerable (EPBC Act)
Three individuals were observed foraging during survey period. Other foraging evidence also observed (chewed Marri nuts). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.
- *Ardea alba* Great Egret – Migratory (EPBC Act)
Observed within a section of the flooded pasture during the survey period. Unlikely to breed on site. .
- *Merops ornatus* Rainbow Bee-eater – Migratory (EPBC Act)
Common seasonal visitor to south west. Observed foraging and roosting in the study area during the survey period. Possibly breeds in some sections of the study area.
- *Pseudocheirus occidentalis* Western Ringtail Possum - S1 (WAWC Act), Vulnerable (EPBC Act)
Appears to be present in low numbers in some sections of the study area. Evidence observed (dreys and scats) is possibly the result of transient individuals temporally residing in the area as opposed to a viable resident population.

Four species of conservation significance may possibly utilise the study area for some purpose at times but their current status on site and/or in the general area is difficult to determine because they were not sighted during the survey period or evidence of use of the study area was not found. Note: Habitat for some species onsite, while considered possibly suitable, may be marginal in extent/quality and species listed below may only visit the area for short periods or as rare/uncommon vagrants:

- *Ardea ibis* Cattle Egret – Migratory (EPBC Act)
May visit flooded pasture areas during wetter months of year. Unlikely to breed on site.
- *Apus pacificus* Fork-tailed Swift – Migratory (EPBC Act)
Rare seasonal visitor. May forage in area but very unlikely to roost.
- *Falco peregrinus* Peregrine Falcon - S4
Study site may form part of larger home range.
- *Falsistrellus mackenziei* Western False Pipistrelle - P4 (DEC Priority Species)
Status in the area difficult to determine. May at least forage on site.

Species of conservation significance that, while possibly present in the general area (e.g. various lakes, estuaries, beaches or larger reserves in the general area), are not listed as potential species due to known localised extinction (and no subsequent recruitment from adjoining areas) and/or lack of suitable habitat and/or the presence of feral predators:

- *Burhinus grallarius* Bush Stone Curlew - P4 (DEC Priority Species)
Regionally extinct. Majority of the habitat in the study area is unsuitable due to lack of daytime shelter required by this species.
- *Psophodes nigrogularis nigrogularis* Western Whipbird (western heath subsp) - S1 (WAWC Act), Endangered (EPBC Act)
Regionally extinct. Habitat in the study area is unsuitable for this species due to lack of dense midstorey vegetation.
- *Botaurus poiciloptilus* Australasian Bittern – S1 (WAWC Act)
Habitat on site is unsuitable for this species.
- *Ixobrychus flavicollis* Black Bittern – P2 (DEC Priority Species)
Habitat on site is unsuitable for this species.
- *Ixobrychus minutus* Little Bittern – P4 (DEC Priority Species)
Habitat on site is unsuitable for this species.
- *Haliaeetus leucogaster* White-bellied Sea-Eagle – Migratory (EPBC Act)
Unsuitable habitat. May fly over occasionally.
- *Charadrius rubricollis* Hooded Plover – P4 (DEC Priority Species)
Unsuitable habitat.
- *Ninox connivens connivens* Barking Owl – P2 (DEC Priority Species)
Habitat appears very marginal for this species and it is unlikely to be specifically attracted to the site.
- *Tyto novaehollandiae* Masked Owl – P3 (DEC Priority Species)
Habitat appears very marginal for this species and it is unlikely to be specifically attracted to the site.
- *Phascogale tapoatafa ssp* Southern Brush-tailed Phascogale - S1 (WAWC Act)
Status in the area is difficult to determine. Better quality vegetation present to the west of the study area (Lot 200) maybe suitable, though the total area of the remnant would limit the long term viability of a population. Limited suitable habitat within the study area is marginal and would be unlikely to support a population of this species.
- *Isodon obesulus fusciventer* Southern Brown Bandicoot – P5 (DEC Priority Species)
There is very limited areas of suitable habitat for this species to persist within the study area (dense groundcover) and it is unlikely that a population could exist on site.

- *Dasyurus geoffroii* Chuditch - S1 (WAWC Act), Vulnerable (EPBC Act)
Locally extinct. Transient individuals may very rarely be present but the area is too small and of a quality too poor to maintain a population of this species.
- *Setonix brachyurus* Quokka – S1 (WAWC Act), Vulnerable (EPBC Act)
Locally extinct. Only known population on the coastal plain is located just south of Bunbury.
- *Macropus irma* Western Brush Wallaby – P4 (DEC Priority Species)
Locally extinct. Habitat within the study area is unsuitable for this species.
- *Hydromys chrysogaster* Water Rat – P4 (DEC Priority Species)
Unsuitable/very marginal habitat. Habitat within the study area is unsuitable for this species due to a lack of permanent water.

6.3.5 Other Species of Significance

Thirteen of the bird species that potentially frequent or occur in the study area are noted as Bush Forever Decreaser Species in the Perth metropolitan region (seven species were sighted/identified as having used the site during the site survey). Decreaser species are a significant issue in biodiversity conservation in the Perth section of the Coastal Plain as there have been marked reductions in range and population levels of many sedentary bird species as a consequence of disturbance and land clearing (Dell & Hyder-Griffiths 2002).

6.4 LOCAL CONSERVATION SIGNIFICANCE OF THE STUDY AREA

Coastal areas in south west western Australia have been altered substantially since European settlement in the 1830's and a variety of environmental factors, in particular habitat fragmentation and fire, will continue to threaten many species of fauna with local extinction (How *et al* 1987). As the local development of land progresses the significance of any remnant vegetation increases.

The results of this fauna assessment shows the study site as a whole hosts (or potentially hosts) a range of fauna species some of which are of special conservation significance. Based on these findings remnant vegetation within the study area must be considered of local significance to fauna, a fact that has previously been recognised (EPA 2008). The majority of the study area however supports (or potentially supports) a significantly depleted fauna assemblage, a consequence of its very degraded state. Most of the fauna species utilising the site are common and widespread and are often found in similar degraded/very degraded habitat present in nearby areas of the Swan Coastal Plain.

Table 2: Listed Threatened, Migratory and Priority Fauna Species Potentially Occurring in Study Area.

Common Name/Species	Conservation Code				Actual Records or Listed as Potentially in General Area			Threatening Processes	Habitat Requirements	Habitat in Project Area/Quali ty	Potential Impact on Habitat
	EPBC Act Status	WAWC Act Status	ICUN Status	DEC Priority Status	EPBC Act Database	DEC Database	Birds Aust. Data Base				
Western Whippoorwill <i>Psophodes nigrolineatus</i>	EN	S1				Yes (1898)		Habitat loss and/or modification, changing fire regimes	Dense shrubland with an open overstorey, the structure of the vegetation being more important than the floristics. Nests found have been in dense bushes in heath adjacent to thickets.	No Species Locally Extinct	None
Hooded Plover <i>Charadrius rubricollis</i>			NT	P4		Yes		Vulnerable to disturbance of foraging and breeding activities on beaches	Broad sandy ocean beaches and bays, coastal and inland salt lakes.	No	None
Great Egret <i>Ardea alba</i>	Migratory (CAMBA, JAMBA)		LC		Yes		Yes	Loss of breeding habitat and declines in water quality.	Wetlands, flooded pasture, dams, estuarine mudflats, mangroves and reefs	Yes	Loss of some degraded foraging habitat
Cattle Egret <i>Ardea ibis</i>	Migratory (CAMBA, JAMBA)		LC		Yes		Yes	Loss of breeding habitat and declines in water quality	Moist pastures with tall grasses, shallow open wetlands and margins, mudflats.	Yes	Loss of some degraded foraging habitat
White-bellied Sea Eagle <i>Haliaeetus leucogaster</i>	Migratory (CAMBA)		LC		Yes			Loss of breeding habitat and declines in water quality	Nests and forages near the coast over islands, reefs, headlands, beaches, bays, estuaries, mangroves, but will also live near seasonally flooded inland swamps, lagoons and floodplains, often far inland on large pools of major rivers. Established pairs usually sedentary, immatures dispersive. Builds a large stick nest, which is used for many seasons in succession.	No	None
Peregrine Falcon <i>Falco peregrinus</i>		S4	LC					Loss of breeding habitat	Diverse from rainforest to arid shrublands, from coastal heath to alpine. Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes. The species utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. It will also occasionally use the abandoned nests of other birds of prey.	Yes	None Likely
Bush Stone Curlew <i>Burhinus grallarius</i>			NT	P4		Yes		Land clearing	Lightly wooded country (including partly cleared forests) near daytime shelter e.g. thickets or long grass.	No Species Locally Extinct	None
Australasian Bittern <i>Botaurus poiciloptilus</i>	VU	S1	EN					Land clearing (wetlands/swamps)	Freshwater wetlands, occasionally estuarine; prefers heavy vegetation such as beds of tall dense <i>Typha</i> , <i>Baumea</i> and sedges in freshwater swamps.	No	None
Black Bittern <i>Ixobrychus exilis</i>			LC	P2		Yes (1931)		Land clearing (wetlands/swamps)	Freshwater pools, swamps and lagoons, well screen with trees. Shelters in dense waterside vegetation.	No	None
Little Bittern <i>Ixobrychus minutus</i>			LC	P4				Land clearing (wetlands/swamps)	Dense beds of Freshwater pools, swamps and lagoons, well screen with trees. Shelters in dense beds of <i>Typha</i> , <i>Baumea</i> and tall rushes in freshwater swamps around lakes and along rivers.	No	None
Forest Red-tailed Black Cockatoo <i>Calyptrornis melanotos</i>	VU	S1	LC		Yes	Yes	Yes	Land clearing and logging.	This subspecies of the Red-tailed Black Cockatoo is restricted to the forests of the south-west. It requires tree hollows to nest and breed and is totally dependent on Jarrah-marri forest	Yes	Loss of foraging and breeding habitat
Baudin's Black-Cockatoo <i>Calyptrornis baudini</i>	VU	S1	EN		Yes	Yes		Land clearing and illegal shooting	Heavily forested areas of the south-west, where it feeds on the seeds of eucalypts and various proteaceous species. It is a nomadic species. Breeding on the coastal plain mostly occurs in areas south of Mandurah during spring/summer, nesting in tree hollows (primarily Marri).	Yes	Loss of foraging and breeding habitat
Carnaby's Black-Cockatoo <i>Calyptrornis melanotos</i>	EN	S1	EN		Yes	Yes		Land clearing and illegal shooting	This species moves around in seasonal flocks to feeding areas in proteaceous scrubs and heaths and eucalypt woodlands as well as pine plantations. Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in though it appears this species is currently expanding its breeding range westward and south into the Jarrah – Marri forest of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain including the region between Mandurah and Bunbury.	Yes	Loss of foraging and breeding habitat

Common Name/Species	Conservation Code				Actual Records or Listed as Potentially in General Area			Threatening Processes	Habitat Requirements	Habitat in Project Area/Quali ty	Potential Impact on Habitat
	EPBC Act Status	WAWC Act Status	ICUN Status	DEC Priority Status	EPBC Act Database	DEC Database	Birds Aust. Data Base				
Masked Owl <i>Tyto novaehollandae</i>			LC	P3				Land clearing and logging	Roosts and nests in heavy forest, hunts over open woodlands and farmlands. Probably breeding in forested deep south west with some autumn–winter wanderings northwards	No Marginal	None
Barking Owl <i>Ninox connexis connexis</i>			LC	P2				Land clearing and logging	Dense vegetation, especially forest and thickets of waterside vegetation such as melaleucas. Roosts in tree hollows.	No	None
Fork-tailed Swift <i>Apus pacificus</i>	Migratory (CAMBA, JAMBA)		LC		Yes			None identified	Low to very high airspace over varied habitat from rainforest to semi desert.	Yes	None
Rainbow Bee-eater <i>Merops ornatus</i>	Migratory (JAMBA)		LC		Yes	Yes		Loss of roosting and breeding sites	Open Country, of woodlands, open forest, semi arid scrub, grasslands, clearings in heavier forest, farmlands. Common as a regular summer migrant to southern Australia (September to April) and breeds underground during this period in areas of suitable soft soil firm enough to support tunnel building.	Yes	Loss of breeding habitat
Western Ringtail Possum <i>Pseudocheirus occidentalis</i>	VU	S1	VU		Yes	Yes		Fox predation. Habitat loss and/or modification, changing fire regimes, damming	Western Ringtail Possums feed, rest and socialise in the canopy, primarily coastal peppermint woodlands and peppermint/tuart associations. Inland, the largest known populations occur in the Upper Warren area east of Manjimup. In this area the Peppermint tree is naturally absent and Jarrah and Marri foliage constitutes the species staple diet. They require tree hollows and/or dense canopy for refuge and nesting.	Yes	Loss of foraging refuge and dispersal habitat
Chuditch <i>Dasyurus geoffroi</i>	VU	S1	VU		Yes	Yes		Competition from and predation by foxes and cats, land clearing, habitat alteration through removal of suitable den logs, poisoning, illegal shooting and road traffic.	This carnivorous marsupial occupies large home ranges, is highly mobile and appears to utilise bush remnant and corridors. Requires a medium sized hollow at or near ground level or will dig burrow under log or stump. Chuditch occur in a wide range of habitats but are more commonly found in woodland, forest and riparian vegetation.	No Species Locally Extinct	None
Southern Brush-tailed Phascogale <i>Phascogale tapoatafa</i>		S1	NT			Yes		Fox and cat predation, reduction in trees with suitable hollows and possibly altered fire regimes.	This arboreal marsupial occurs in forest and woodland where suitable tree hollows are available. Requires small hollows. Prefers dense crown vegetation. Populations fluctuate dramatically in response to invertebrate prey abundance.	No Marginal	None
Quenda <i>Isodon obesulus fusciventer</i>			LC	P5				Fox predation and land clearing	This species prefers areas with dense understorey vegetation, particular around swamps and along watercourses that provide ample protection from predators.	No	None
Western Brush Wallaby <i>Macropus irma</i>			LC	P4		Yes		Fox predation.	The western brush wallaby prefers areas of forest and woodland supporting a dense shrub layer adjacent to small open areas.	No Species Locally Extinct	None
Quokka <i>Setonix brachyurus</i>	VU	S1	VU		Yes			Fox predation, altered fire regimes	Densely vegetated wetlands and tea-tree thickets along creek systems and dense heath on valley slopes. Peppermint and <i>Thomasia</i> species being dominant vegetation items in their diet	No Species Locally Extinct	None
Western False Pipistrelle <i>Falsistrellus mackenziei</i>			NT	P4				Land clearing and logging.	This species of bat occurs in high jarrah forest and coastal woodlands. It roosts in small colonies in tree hollows and forages in the cathedral-like spaces between trees.	Yes Marginal	Loss of roosting habitat
WaterRat <i>Hydromys chrysogaster</i>			LC	P4		Yes		Fox predation and a decline in water quality.	Water rats occur along permanent watercourses where there are freshwater molluscs and crustaceans (its main prey), frogs, small mammals and water birds present. Requires healthy fresh (to brackish) water habitat containing diverse water and bank life.	No	None

6.5 VALUE OF THE STUDY AREA AS A WILDLIFE CORRIDOR

Linkage with adjacent bushland areas has been identified as a natural attribute of high priority in the assessment of a sites regional significance (EPA 2002a, Molly *et al* 2009). Two types of linked (or potentially linked) sequences of ecological communities were identified in the EPA's Strategy, vegetated sequences and river corridors. The vegetated sequences are further divided into two groups – those that link North-South predominantly along landforms and vegetation complexes; and those that link East-West across landform and vegetation complexes (EPA 2002a)

The Greater Bunbury Region (GBR) ecological linkages plan (Appendix 4, EPA 2003) shows the study area as being situated within the north south orientated McLarty/Kemerton/Twin Rivers/Preston River/Gwindinup linkage. Detailed analyses of potential ecological linkages recently completed for the south west (Molloy *et al* 2009) also shows the study area as being close to a regional ecological linkage.

Examination of air photos and observations made during the field reconnaissance survey shows the general area is largely cleared and the value of the remnant vegetation within the site relates more to its potential function as “stepping stones” rather than part of a continuous vegetated link. These “stepping stones” facilitate to a certain degree the maintenance of ecological processes and the movement of organisms within and across a landscape (Molloy *et al* 2009) and should if possible be maintained in the long term.

7. ECOLOGICAL IMPACTS AND MANAGEMENT

7.1 POTENTIAL IMPACTS

In general the most significant potential impacts to fauna of any development include:

- Loss of vegetation/fauna habitat that is used for foraging, breeding, roosting, or dispersal (includes loss of hollow bearing trees),
- Fragmentation of vegetation/fauna habitat which may restrict the movement of some fauna species,
- Modifications to surface hydrology, siltation of creek lines,
- Changes to fire regimes,
- Pollution (e.g. oil spills),

- Noise/Light,
- Spread of plant pathogens (e.g. dieback) and weeds,
- Potential increase in the number of predatory introduced species (e.g. domestic cats), and
- Death or injury of fauna during clearing and construction.

The exact nature of any development at the site is not finalised and therefore the exact magnitude of the impact of fauna and fauna habitat cannot be predicted. If any future development requires the clearing of vegetation then the loss or degradation of fauna habitat is likely to result. The impact on the significant species listed as potentially being present will vary depending on their current degree of utilisation/population densities and preferred habitat requirements (e.g. quantity and quality of potential foraging and breeding habitat that is affected).

Of most significance is the presence on site of black cockatoo and Western Ringtail Possum habitat. Potential impacts on these species and/or their habitat will need to be addressed during the planning process and where reasonable and practical planning should aim to retain/protect and enhance habitat so that they can persist and/or continue to utilise the site.

7.2 MINIMISING IMPACTS

As the exact nature of any proposed development is unknown to the author the following generalised recommendations are presented and should be incorporated into the planning process where possible. The recommendations aim to reduce the impact on fauna and fauna habitat as much as reasonable and practicable. It is recommended that:

- Planning for development should where possible aim to retain and protect as much remnant vegetation on site. In particular the best quality woodland habitat as identified in EPA Bulletin 1282 (EPA 2008) should be a priority for protection (part recommendation Area E – Lot 104).
- Landscaped areas should be revegetated with local seed stock that includes cockatoo food plants, specifically *Eucalyptus*, *Corymbia*, *Banksia*, *Hakea*, and *Allocasuarina*. The final selection of suitable species should be carried out after liaison with appropriate experts or local land care groups to ascertain which species are most suitable for the area.

- During site works areas requiring clearing should be clearly marked and access to other areas restricted to prevent accidental clearing of areas to be retained.
- No dead, standing or fallen timber should be removed unnecessarily. Logs (hollow or not) and other debris resulting from land clearing should be used to enhance fauna habitat in untouched and rehabilitated areas if possible.
- A Construction and Operations Fire Management Plan should be prepared to reduce the risk of unplanned fires and provide contingency measures to minimise any associated impacts. The plan will include a contingency and response plan in the event of any bushfires that commence as a result of the works on site.
- All staff working on site should be made aware that native fauna is protected. Personnel working on the project should not be allowed to bring firearms, other weapons or pets onsite.
- Native fauna injured during clearing or normal site operations should be taken to a designated veterinary clinic or a DEC nominated wildlife carer.
- Fuel storage facilities should be bunded.
- Any trenching required for services should be kept open for only as long as necessary and suitable escape ramps and bridging provided if the site is to be left unattended for extended periods. Significant sized trenches should be inspected for fauna immediately prior to filling.

Once detailed plans for the development of the study area are finalised the impact on fauna should be reviewed as site/species specific management plans may be required.

8. LEGISLATIVE OBLIGATIONS

8.1 WILDLIFE CONSERVATION ACT 1950

The objective of the *Wildlife Conservation Act 1950* is to provide for the protection of wildlife. The Act is administered by the Executive Director of the Department of Environment and Conservation, under the direction and control of the Minister for the Environment. Under section 14, "Protection of Fauna", of this Act, all fauna is wholly protected throughout the State at all times, unless declared by the Minister by notice in the Government Gazette. Under section 14(2)(ba) of The Act, Fauna Notices are made by the Minister for the Environment listing specially protected fauna.

Disturbance or destruction of any native fauna over and above that reasonably required for construction works and access is considered an offence under the Act and the developer should take the necessary steps to inform construction personnel of this fact. The developer should also, as part of their management plan implement procedures that will reduce the chances of wildlife being injured or killed during clearing and construction on the site.

8.2 COMMONWEALTH ENVIRONMENTAL PROTECTION & BIODIVERSITY CONSERVATION ACT 1999

A number of fauna species known to or potentially present within the study area are listed under the federal *Environment Protection and Biodiversity Conservation Act (EPBC Act, 1999)*. The objective of the *EPBC Act* is to provide for the protection of the environment, especially those aspects that are of national significance, promote ecologically sustainable development, the conservation of biodiversity and a cooperative approach to the protection and management of the environment.

If an action (e.g. clearing of vegetation) is deemed to have a potential significant impact (as detailed in “Principal Significant Impact Guidelines 1.1” - DEW 2006) on listed species, a referral to the Department of Environment, Water, Heritage and the Arts (DEWHA) is required.

The results of the fauna assessment reported on here suggest that several species listed under the *EPBC Act* potentially utilise the study site to some degree and any the project should aim to avoid having a significant impact on any one of them. The conservation of as much vegetation as possible will simplify any referral or assessment process required under the *EPBC Act*. Where impacts cannot be avoided, every attempt to minimise impacts should be made. The recommendations made in section 7.2 are provided to facilitate this.

If the clearing of vegetation (including black cockatoo and WRP habitat) is unavoidable the DEWHA will typically request onsite mitigation through revegetation and retention of key habitat as part of the approval process. Currently a ratio of 4:1 is seen as a minimum requirement for offsetting cockatoo foraging habitat loss by way of plantings (i.e. 4ha for every 1ha lost). For WRPs the ratio is 3:1. Offsetting the loss of cockatoo breeding habitat by plantings is generally viewed by DEWHA as needing to be higher (in the region of 10:1).

Obligations under the *EPBC Act* should be re-assessed when development plans are finalised.

9. CONCLUSION

Potentially, 11 native mammals (includes eight bat species), 86 bird, 20 reptile and seven frog species could be expected to occur in or utilise at times, the study area. Thirteen introduced species could also occur. Of the 124 native animals that are listed as potentially occurring at the site, five are considered to be endangered/vulnerable or in need of special protection under state and/or federal law. In addition four migratory species may frequent the site at times and a single DEC priority species was identified as possibly present.

Planning of the proposal should take into account the potential presence of several species of conservation significance and impact on these species will need to be minimised so as to simplify any referral or assessment process required under the federal *EPBC Act* or the state administered EP Act. The recommendations made aim to reduce the impact on fauna and should be incorporated into the sites development plan where considered reasonable and practical.

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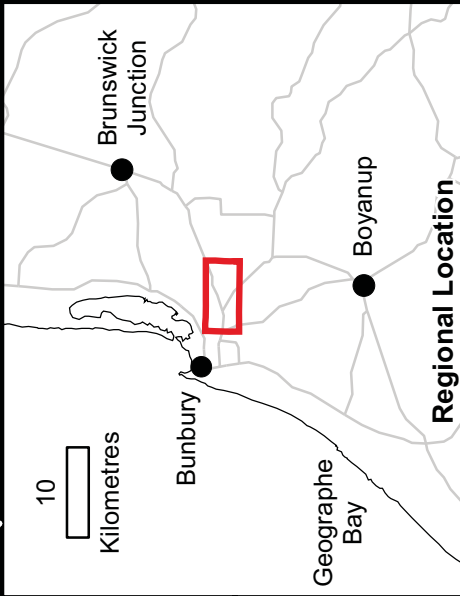
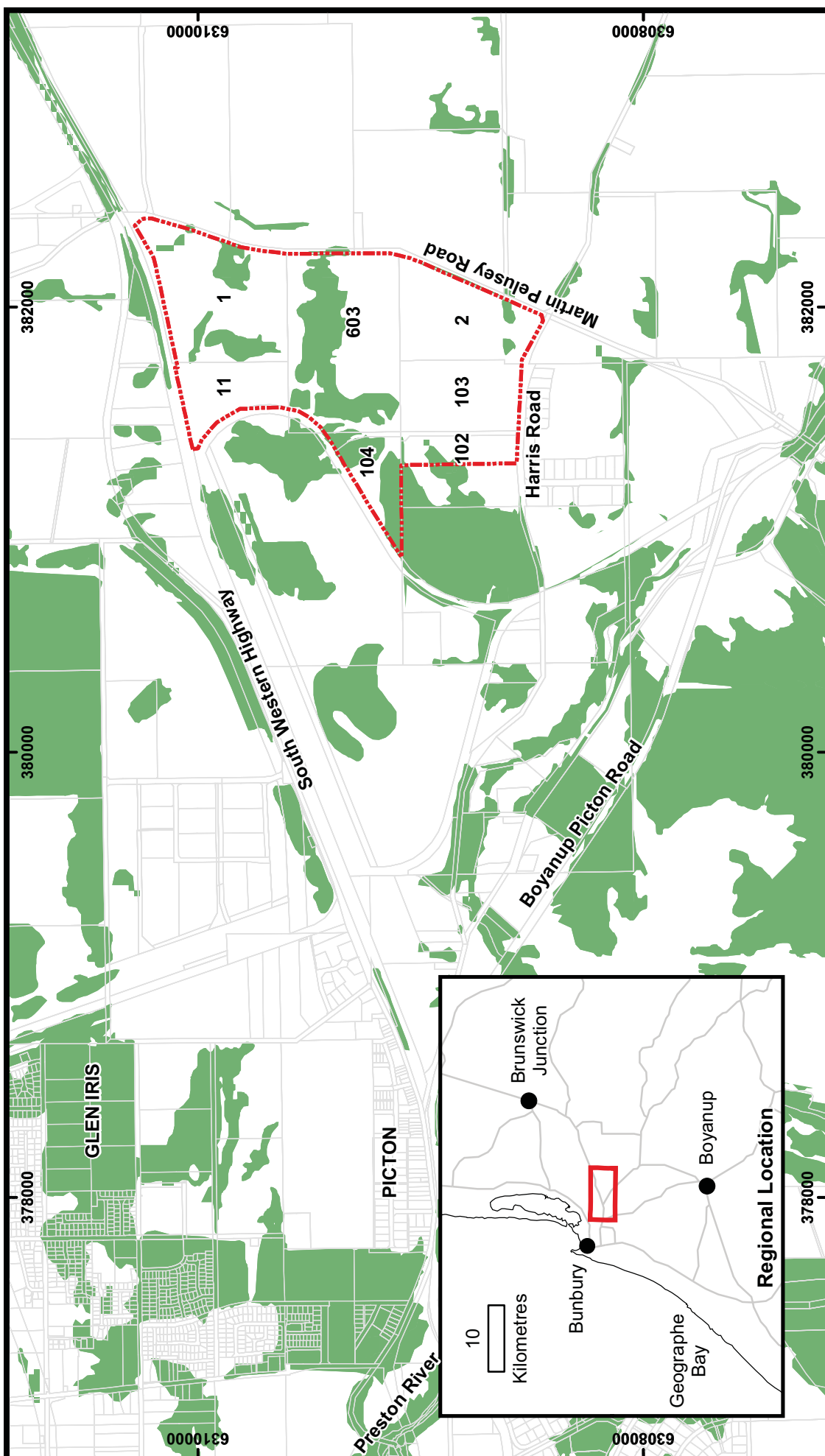
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FIGURES



Legend

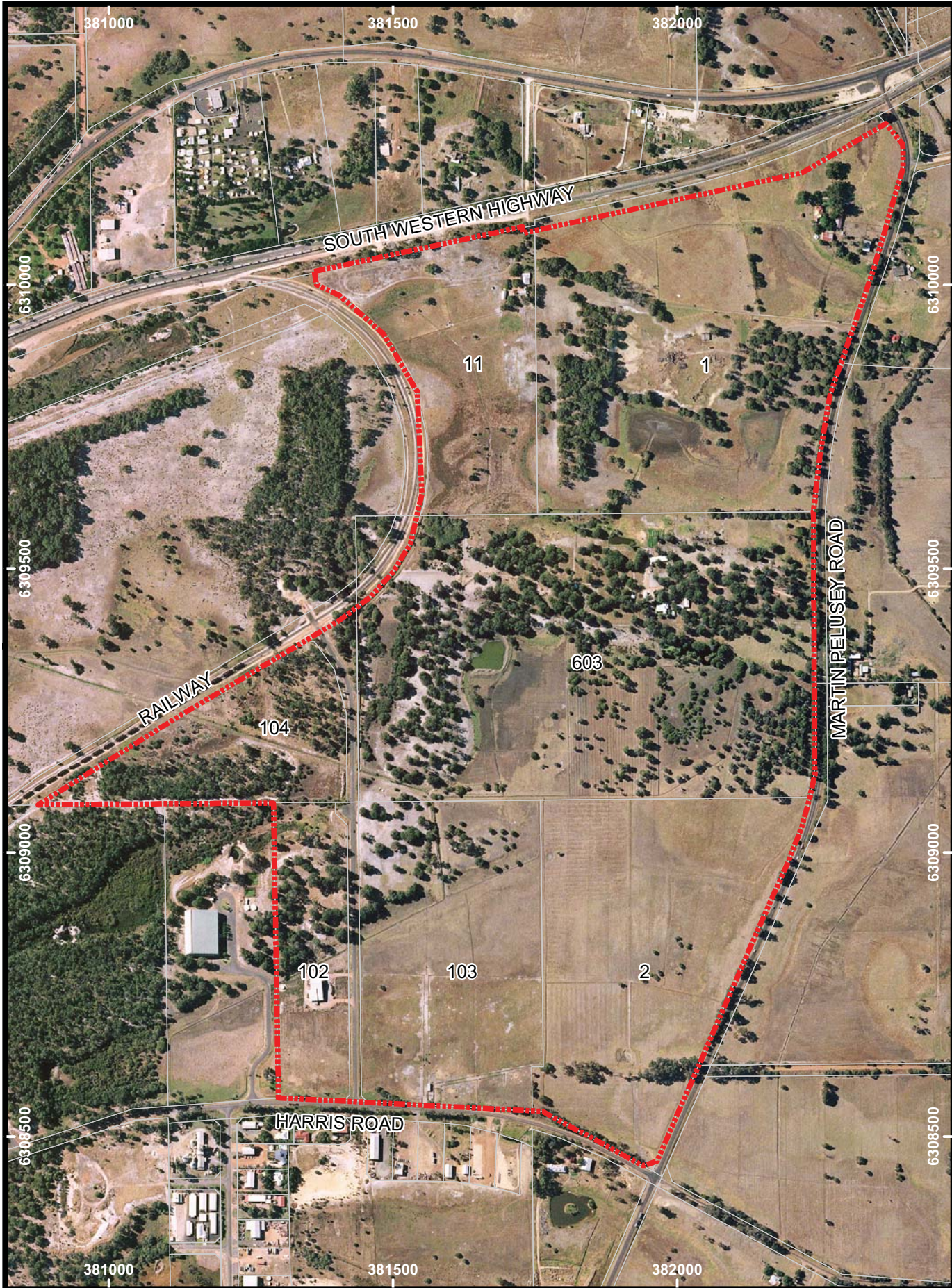
- Study area
- Cadastral Boundaries (Existing)
- Remnant Vegetation





Picton East

Study Area and Surrounds

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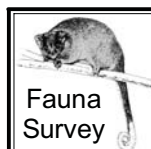


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-  Study area



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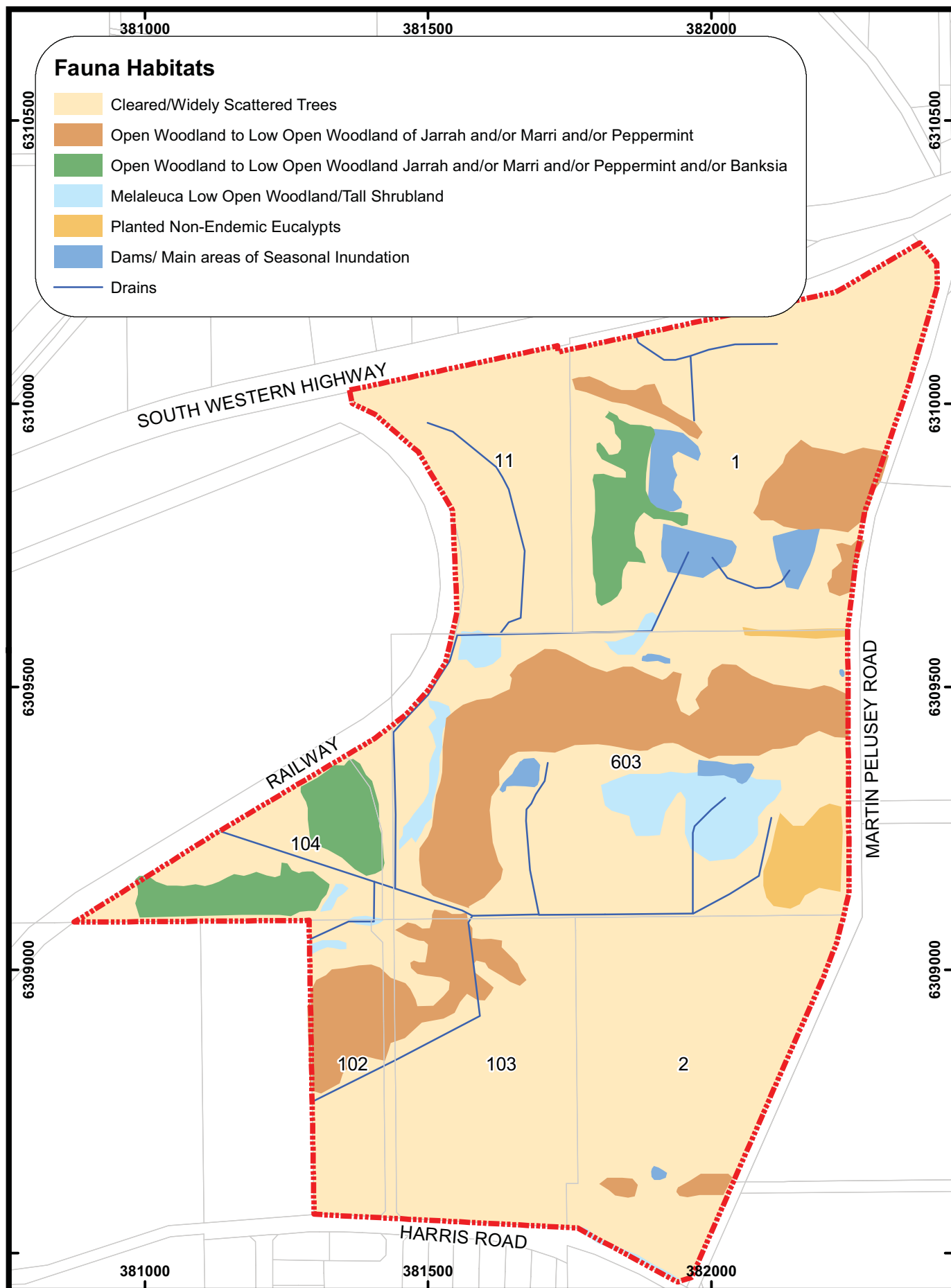


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Picton East Study Area Air Photo

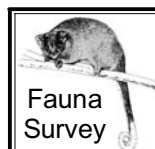
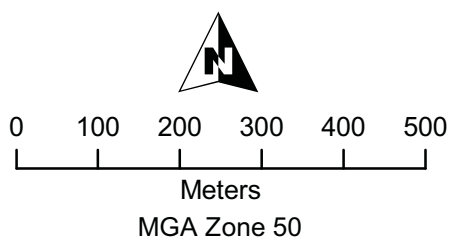
Fauna Habitats

- Cleared/Widely Scattered Trees
- Open Woodland to Low Open Woodland of Jarrah and/or Marri and/or Peppermint
- Open Woodland to Low Open Woodland Jarrah and/or Marri and/or Peppermint and/or Banksia
- Melaleuca Low Open Woodland/Tall Shrubland
- Planted Non-Endemic Eucalypts
- Dams/ Main areas of Seasonal Inundation
- Drains



Legend

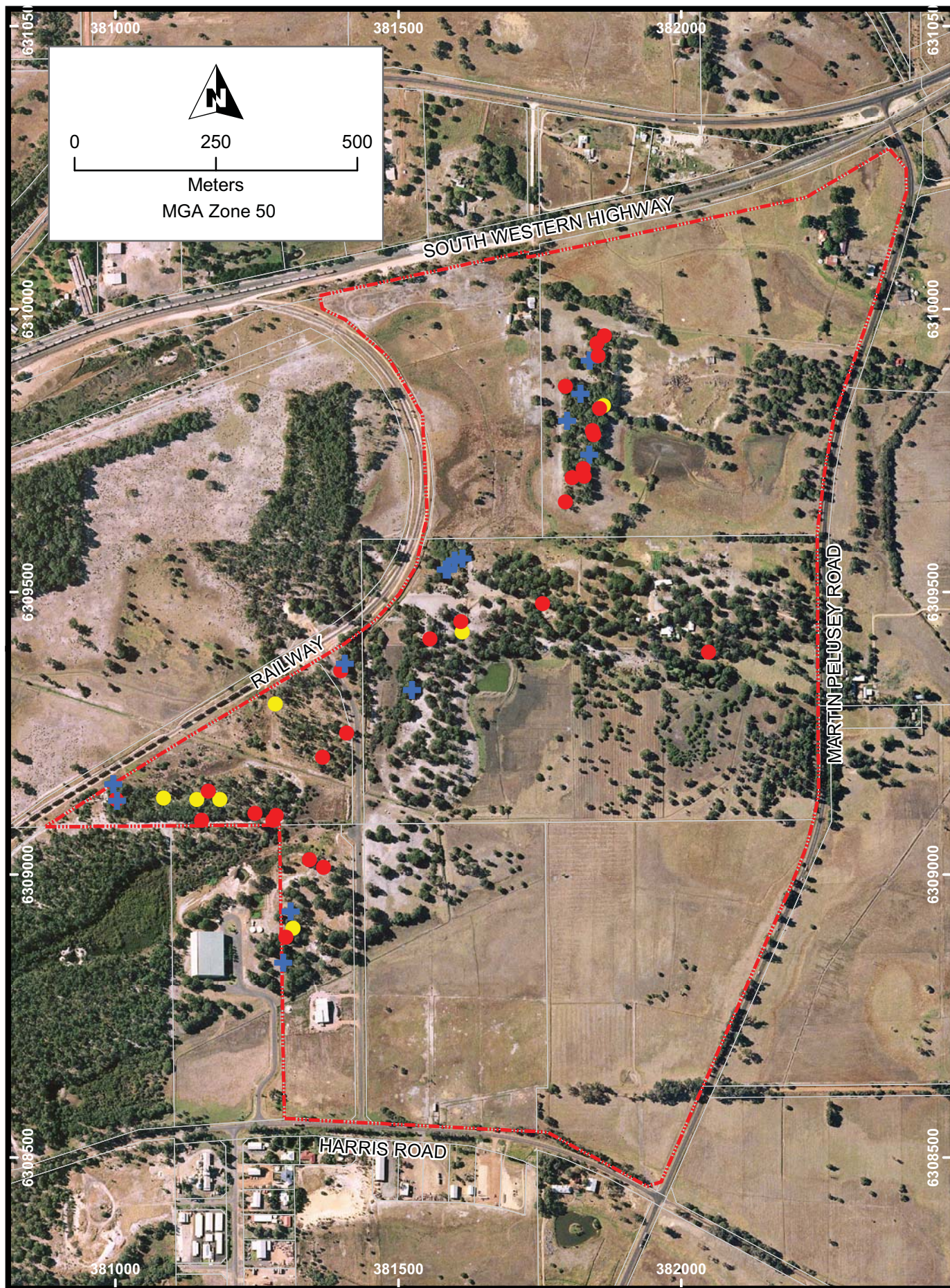
- Cadastral Boundaries
- Study area



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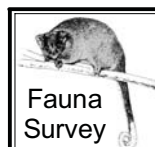
Picton East

Fauna Habitats



Legend

- | | | | |
|---|----------------------|---|---------------------------------|
|  | Cadastral Boundaries |  | Habitat Tree with Small Hollows |
|  | Study area |  | Habitat Tree with Large Hollows |
| | |  | WRP Drey |



Fauna
Survey

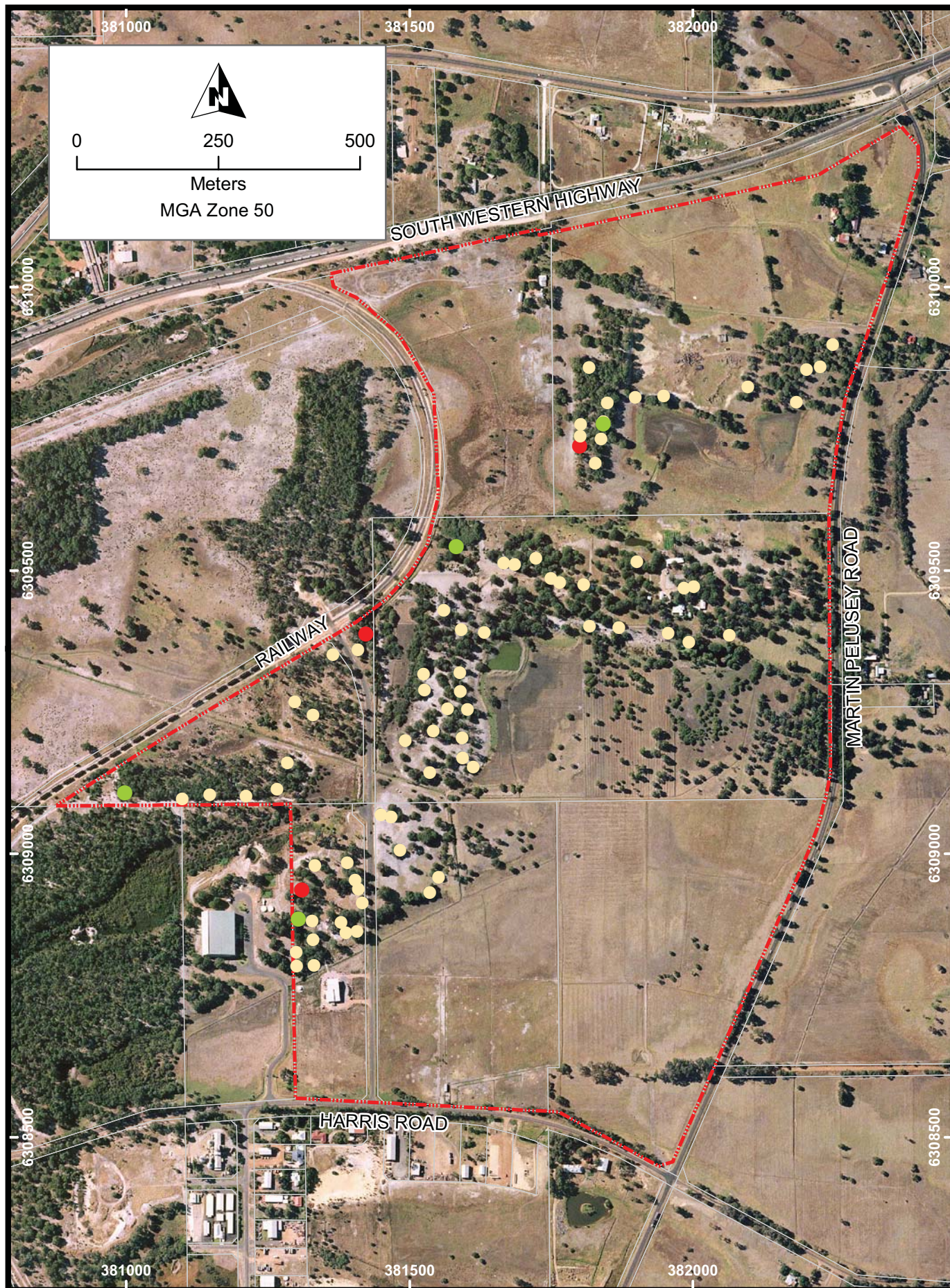
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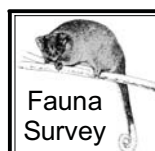
Picton East

Habitat Trees & WRP Dreys



Legend

- | | |
|--|--|
|  Cadastral Boundaries |  No WRP Scats Observed |
|  Study area |  Small Number of WRP Scats Observed |
| |  High Number of WRP Scats Observed |



DRAWN: G Harewood

DATE : Oct 2009

SCALE: 1: 9,250

Picton East

WRP Scat Densities

PLATES



Plate 1: Cleared pasture with scattered trees – Lot 2.



Plate 2: Low open woodland dominated by Banksia with various densities of Jarrah, Marri and Peppermint over very open low shrubland and grassland – Lot 104.



Plate 3: Open woodland of Jarrah and Marri over low open woodland of Peppermint over grassland – Lot 603.



Plate 4: Low open woodland of Melaleuca over seasonally inundated grassland – Lot 603.



Plate 5: Planted non-endemic Eucalypts – Lot 603.



Plate 6: Manmade Dam - Lot 603.

APPENDIX A

CONSERVATION CATEGORIES

EPBC Act (1999) Threatened Fauna Categories

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the EPBC Act

Note: Only species in those categories marked with an asterix are matters of national environmental significance under the EPBC Act.

Western Australian Wildlife Conservation Act (1950) Threatened Fauna Categories

Category	Code	Description
Schedule 1	S1	Fauna which is rare or likely to become extinct
Schedule 2	S2	Fauna which is presumed extinct
Schedule 3	S3	Birds which are subject to an agreement between the governments of Australia and Japan (JAMBA) relating to the protection of migratory birds and birds in danger of extinction
Schedule 4	S4	Fauna that is otherwise in need of special protection

Note: The *WAWC Act* also uses the categories defined by the *EPBC Act* to further define the status of species in the S1 category.

Western Australian DEC Priority Fauna Categories

Category	Code	Description
Priority 1	P1	Taxa with few, poorly known populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring (Not currently threatened or in need of special protection, but could be if present circumstances change)
Priority 5	P5	Taxa in need of monitoring (Not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years)

IUCN Red List Threatened Species Categories

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.

A full list of categories and their meanings are available at:

http://www.iucnredlist.org/info/categories_criteria2001#categories

APPENDIX B

HABITAT TREE COORDINATES

Habitat Trees Observed - Picton East

MGA

mN	mE	Decription	Comments
6309013.543	381368.1255	Small hollow	bees
6309027.095	381342.8316	Small hollow	bees
6308889.263	381301.8665	Small hollow	
6309095.430	381278.7093	Small hollow	
6309105.116	381284.4912	Small hollow	
6309109.089	381246.7502	Small hollow	
6309096.101	381152.4456	Small hollow	
6309133.257	381001.9924	Small hollow	
6309147.263	381164.6898	Small hollow	
6309207.586	381366.3748	Small hollow	
6309250.973	381408.4975	Small hollow	
6309360.463	381398.9402	Small hollow	
6309447.140	381610.5469	Small hollow	
6309416.531	381555.8508	Small hollow	
6309479.397	381754.8785	Small hollow	
6309394.259	382048.6222	Small hollow	
6309823.655	381855.8548	Small hollow	
6309785.800	381843.4438	Small hollow	
6309778.613	381845.2346	Small hollow	
6309718.509	381827.0451	Small hollow	
6309704.295	381828.1490	Small hollow	bees
6309658.246	381795.8183	Small hollow	
6309702.563	381807.0705	Small hollow	
6309862.837	381795.1861	Small hollow	
6309917.709	381853.6200	Small hollow	
6309939.117	381851.3488	Small hollow	
6309953.140	381864.5157	Small hollow	
6308905.682	381314.2294	Large Hollow	
6309132.901	381184.5683	Large Hollow	
6309135.197	381085.1063	Large Hollow	
6309132.784	381144.2341	Large Hollow	
6309302.394	381282.5039	Large Hollow	
6309428.134	381613.4129	Large Hollow	
6309829.472	381862.7645	Large Hollow	

APPENDIX C

FAUNA OBSERVED OR POTENTIALLY IN STUDY AREA

Fauna Observed or Potentially in Study Area

Picton East - Picton, W.A.

33.347505°S 115.730545°E

Compiled by Greg Harewood - October 2009

Recorded (Sighted/Heard/Signs) = +

Class Family Species	Common Name	Conservation Status	Recorded October 2009
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Amphibia

Myobatrachidae

Ground or Burrowing Frogs

<i>Crinia georgiana</i>	Quacking Frog	LC	
<i>Crinia glauerti</i>	Clicking Frog	LC	+
<i>Crinia insignifera</i>	Squelching Froglet	LC	
<i>Heleioporus eyrei</i>	Moaning Frog	LC	
<i>Limnodynastes dorsalis</i>	Western Banjo Frog	LC	

Hylidae

Tree or Water-Holding Frogs

<i>Litoria adelaidensis</i>	Slender Tree Frog	LC	
<i>Litoria moorei</i>	Motorbike Frog	LC	

Reptilia

Gekkonidae

Geckoes

<i>Christinus marmoratus</i>	Marbled Gecko		
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Pygopodidae

Legless Lizards

<i>Lialis burtonis</i>	Burtons's Legless Lizard		
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Agamidae

Dragon Lizards

<i>Pogona minor minor</i>	Western Bearded Dragon		
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Varanidae

Monitor's or Goanna's

<i>Varanus gouldii</i>	Bungarra or Sand Monitor		
<i>Varanus rosenbergi</i>	Heath Monitor		

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Class Family Species	Common Name	Conservation Status	Recorded October 2009
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Scincidae

Skinks

<i>Acritoscincus trilineatum</i>	South-western Cool Skink		
<i>Cryptoblepharus buehnananii</i>	Fence Skink		+
<i>Ctenotus fallens</i>	West Coast Ctenotus		
<i>Ctenotus labillardieri</i>	Red-legged Ctenotus		
<i>Egernia kingii</i>	King's Skink		
<i>Egernia napoleonis</i>	South-western Crevice Egernia		
<i>Glaphyromorphus gracilipes</i>			
<i>Hemiergis peronii peronii</i>			
<i>Hemiergis quadrilineata</i>	Two-toed earless Skink		
<i>Lerista elegans</i>	West Coast Four-toed Lerista		
<i>Menetia greyii</i>	Dwarf Skink		
<i>Morethia lineoocellata</i>	West Coast Morethia		
<i>Tiliqua rugosa rugosa</i>	Western Bobtail		+

Elapidae

Elapid Snakes

<i>Notechis scutatus</i>	Tiger Snake		
<i>Pseudonaja affinis</i>	Dugite		

Aves

Casuariidae

Emus, Cassowaries

<i>Dromaius novaehollandiae</i>	Emu	LC	+
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Phasianidae

Quails, Pheasants

<i>Coturnix pectoralis</i>	Stubble Quail	LC	
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Class Family Species	Common Name	Conservation Status	Recorded October 2009
Anatidae Geese, Swans, Ducks			
<i>Anas gracilis</i>	Grey Teal	LC	+
<i>Anas platyrhynchos</i>	Mallard	Introduced	
<i>Anas superciliosa</i>	Pacific Black Duck	LC	+
<i>Chenonetta jubata</i>	Australian Wood Duck	LC	+
<i>Tadorna tadornoides</i>	Australian Shelduck	LC	+
Podicipedidae Grebes			
<i>Poliiocephalus poliocephalus</i>	Hoary-headed Grebe	LC	
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe	LC	+
Ardeidae Herons, Egrets, Bitterns			
<i>Ardea alba</i>	Great Egret	Migratory CA JA	+
<i>Ardea ibis</i>	Cattle Egret	Migratory CA JA	
<i>Ardea novaehollandiae</i>	White-faced Heron	LC	+
<i>Ardea pacifica</i>	White-necked Heron	LC	+
<i>Nycticorax caledonicus</i>	Rufous Night Heron	LC	
Threskiornithidae Ibises, Spoonbills			
<i>Platalea flavipes</i>	Yellow-billed Spoonbill	LC	
<i>Threskiornis molucca</i>	Australian White Ibis	LC	+
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	LC	+

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Class Family Species	Common Name	Conservation Status	Recorded October 2009
Accipitridae Kites, Goshawks, Eagles, Harriers			
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	LC	
<i>Accipiter fasciatus</i>	Brown Goshawk	LC	
<i>Aquila audax</i>	Wedge-tailed Eagle	LC	
<i>Aquila morphnoides</i>	Little Eagle	LC	
<i>Circus approximans</i>	Swamp Harrier	LC	
<i>Elanus caeruleus</i>	Black-shouldered Kite	LC	
<i>Haliastur sphenurus</i>	Whistling Kite	LC	
Falconidae Falcons			
<i>Falco berigora</i>	Brown Falcon	LC	
<i>Falco cenchroides</i>	Australian Kestrel	LC	+
<i>Falco longipennis</i>	Australian Hobby	LC	
<i>Falco peregrinus</i>	Peregrine Falcon	S4 LC	
Rallidae Rails, Crakes, Swampheens, Coots			
<i>Fulica atra</i>	Eurasian Coot	LC	+
Columbidae Pigeons, Doves			
<i>Columba livia</i>	Domestic Pigeon	Introduced	
<i>Ocyphaps lophotes</i>	Crested Pigeon	LC	
<i>Phaps chalcoptera</i>	Common Bronzewing	LC	+
<i>Streptopelia senegalensis</i>	Laughing Turtle-Dove	Introduced	

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Class Family Species	Common Name	Conservation Status	Recorded October 2009
Psittacidae Parrots			
<i>Cacatua roseicapilla</i>	Galah	LC	
<i>Cacatua sanguinea</i>	Little Corella	Introduced	
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	S1 VU VU Be LC	+
<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo	S1 EN Bp VU C2a(ii)	+
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	S1 EN Bp EN A2bcd+3bcd	+
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet	LC	
<i>Neophema elegans</i>	Elegant Parrot	LC	
<i>Platycercus icterotis</i>	Western Rosella		
<i>Platycercus spurius</i>	Red-capped Parrot	LC	+
<i>Platycercus zonarius semitorquatus</i>	Twenty-eight Parrot	LC	+
<i>Polytelis anthopeplus</i>	Regent Parrot	LC	
Cuculidae Parasitic Cuckoos			
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	LC	
<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo	LC	+
<i>Chrysococcyx lucidus</i>	Shining Bronze Cuckoo	LC	
<i>Cuculus pallidus</i>	Pallid Cuckoo	LC	
Strigidae Hawk Owls			
<i>Ninox novaeseelandiae</i>	Boobook Owl	LC	
Tytonidae Barn Owls			
<i>Tyto alba</i>	Barn Owl	LC	
Podargidae Frogmouths			
<i>Podargus strigoides</i>	Tawny Frogmouth	LC	
Aegotheidae Owlet-nightjars			
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	LC	

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Class Family Species	Common Name	Conservation Status	Recorded October 2009
Apodidae Swifts, Swiftlets			
<i>Apus pacificus</i>	Fork-tailed Swift	Migratory CA JA LC	
Halcyonidae Tree Kingfishers			
<i>Dacelo novaeguinea</i>	Laughing Kookaburra	Introduced	
<i>Todiramphus sanctus</i>	Sacred Kingfisher	LC	+
Meropidae Bee-eaters			
<i>Merops ornatus</i>	Rainbow Bee-eater	Migratory JA LC	+
Maluridae Fairy Wrens, GrassWrens			
<i>Malurus splendens</i>	Splendid Fairy-wren	Bh LC	+
Acanthizidae Thornbills, Geryones, Fieldwrens & Whitefaces			
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill	Bh LC	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	Bh LC	+
<i>Acanthiza inornata</i>	Western Thornbill	Bh LC	
<i>Gerygone fusca</i>	Western Gerygone	LC	+
<i>Sericornis frontalis</i>	White-browed Scrubwren	Bh LC	+
<i>Smicrornis brevirostris</i>	Weebill	LC	
Pardalotidae Pardalotes			
<i>Pardalotus striatus</i>	Striated Pardalote	LC	+

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Class Family Species	Common Name	Conservation Status	Recorded October 2009
Meliphagidae Honeyeaters, Chats			
<i>Acanthorhynchus superciliosus</i>	Western Spinebill	LC	
<i>Anthochaera carunculata</i>	Red Wattlebird	LC	+
<i>Epthianura albifrons</i>	White-fronted Chat	LC	
<i>Lichenostomus virescens</i>	Singing Honeyeater	LC	
<i>Lichmera indistincta</i>	Brown Honeyeater	LC	+
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	Bp LC	
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	Bp LC	
Neosittidae Sitellas			
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Bh LC	
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers			
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	LC	
<i>Pachycephala pectoralis</i>	Golden Whistler	Bh LC	+
<i>Pachycephala rufiventris</i>	Rufous Whistler	LC	+
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo			
<i>Grallina cyanoleuca</i>	Magpie-lark	LC	+
<i>Rhipidura fuliginosa</i>	Grey Fantail	LC	+
<i>Rhipidura leucophrys</i>	Willie Wagtail	LC	+
Campephagidae Cuckoo-shrikes, Trillers			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	LC	+
<i>Lalage tricolor</i>	White-winged Triller	LC	
Artamidae Woodswallows, Butcherbirds, Currawongs			
<i>Artamus cinereus</i>	Black-faced Woodswallow	LC	
<i>Artamus cyanopterus</i>	Dusky Woodswallow	Bp LC	

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Class Family Species	Common Name	Conservation Status	Recorded October 2009
Cracticidae Currawongs, Magpies & Butcherbirds			
<i>Cracticus tibicen</i>	Australian Magpie	LC	+
<i>Cracticus torquatus</i>	Grey Butcherbird	LC	+
Corvidae Ravens, Crows			
<i>Corvus coronoides</i>	Australian Raven	LC	+
Motacillidae Old World Pipits, Wagtails			
<i>Motacilla alba</i>	White Wagtail	Migratory CA LC	+
Dicaeidae Flowerpeckers			
<i>Dicaeum hirundinaceum</i>	Mistletoebird	LC	
Hirundinidae Swallows, Martins			
<i>Hirundo neoxena</i>	Welcome Swallow	LC	+
<i>Hirundo nigricans</i>	Tree Martin	LC	
Sylviidae Old World Warblers			
<i>Cincloramphus cruralis</i>	Brown Songlark	LC	
<i>Cincloramphus mathewsi</i>	Rufous Songlark	LC	
Zosteropidae White-eyes			
<i>Zosterops lateralis</i>	Grey-breasted White-eye	LC	+
Mammalia			
Phalangeridae Brushtail Possums, Cuscuses			
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	LR/LC	+
Pseudocheiridae Ringtail Possums			
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	S1 VU VU C2a	+
Macropodidae Kangaroos, Wallabies			
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	LR/LC	+

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Class Family Species	Common Name	Conservation Status	Recorded October 2009
Molossidae Freetail Bats			
<i>Mormopterus planiceps</i>	Southern Freetail-bat	LR/LC	
<i>Tadarida australis</i>	White-striped Freetail-bat	LR/LC	
Vespertilionidae Ordinary Bats			
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	LR/LC	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	LR/LC	
<i>Falsistrellus mackenziei</i>	Western False Pipistrelle	P4 VU A2c	
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	LR/LC	
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	LR/LC	
<i>Vespadelus regulus</i>	Southern Forest Bat	LR/LC	
Muridae Rats, Mice			
<i>Mus musculus</i>	House Mouse	Introduced	
<i>Rattus rattus</i>	Black Rat	Introduced	
Canidae Dogs, Foxes			
<i>Vulpes vulpes</i>	Red Fox	Introduced	
Felidae Cats			
<i>Felis catus</i>	Cat	Introduced	
Equidae Horses			
<i>Equus caballus</i>	Horse	Introduced	+
Bovidae Horned Ruminants			
<i>Bos taurus</i>	European Cattle	Introduced	+
<i>Ovis aries</i>	Domestic Sheep	Introduced	+
Leporidae Rabbits, Hares			
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced	+

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APPENDIX D

DEC DATABASE SEARCH RESULTS & EPBC DATABASE SEARCH RESULTS

33.2637°S 115.6131°E / 33.4432°S 115.8262°E

Picton area (plus ~10km buffer) #2857

* *Date* *Certainty* *Seen* *Location Name**Method***Schedule 1 - Fauna that is rare or is likely to become extinct*****Dasyurus geoffroii*****Chuditch***1 records*

This carnivorous marsupial occupies large home ranges, is highly mobile and appears able to utilise bush remnants and corridors.

Date	Certainty	Seen	Location Name	Method
2000	1	1	Eaton/Pelican Point	Dead

Phascogale tapoatafa* ssp. (WAM M434)*Brush-tailed Phascogale, Wambenger***5 records*

This arboreal marsupial occurs in forest and woodland where suitable tree hollows are available. Populations fluctuate dramatically in response to invertebrate prey abundance.

1999	1	2	North Boyanup	Caught or trapped
2003	1	1	Glen Iris	Night sighting
2008	1	1	Bunbury	Dead
2008	1	1	College Grove	Night sighting
2008	1	1	Australind	Dead

Pseudocheirus occidentalis**Western Ringtail Possum***22 records*

This species occurs in areas of forest and dense woodlands and requires tree hollows and/or dense canopy for refuge and nesting.

1998	1	1	Dalyellup	Night sighting
2003	1	1	Davenport	Day sighting
2005	1	1	Glen Iris/Vittoria	Dead
2006	1	1	Eaton	Day sighting
2006	1	1	Carey Park	Day sighting
2006	1	0	Millbridge/Waterloo	Dead
2006	2	1	Stratham	Dead
2006	1	2	Gelorup	Night sighting
2007	1	1	Eaton/Picton East	Dead
2007	1	2	Dardanup	Day sighting
2007	1	1	Waterloo	Day sighting
2007	1	3	Gelorup	Night sighting
2007	1	1	Eaton	Dead
2008	1	1	Bunbury	Dead
2008	1	1	Bunbury	Day sighting
2008	1	1	Gelorup	Dead
2008	1	1	Gelorup	Caught or trapped
2008	1	0	Gelorup	Definite signs
2008	1	1	Davenport	Dead
2008	1	1	Bunbury	Dead
2008	1	1	Glen Iris	Dead
2008	1	1	South Bunbury	Dead

Diomedea exulans**Wandering Albatross***1 records*

This species is an occasional visitor to south and southwest coastal Western Australia. It breeds on subantarctic and antarctic islands.

1939	1	1	Bunbury	Dead
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33.2637°S 115.6131°E / 33.4432°S 115.8262°E

Picton area (plus ~10km buffer) #2857

* Date	Certainty	Seen	Location Name	Method
<i>Macronectes giganteus</i>			Southern Giant Petrel	1 records
2008	1	1	South Bunbury	Day sighting
<i>Thalassarche carteri</i>			Indian Yellow-nosed Albatross	1 records
1939	1		Bunbury	Day sighting
<i>Thalassarche melanophrys</i>			Black-browed Albatross	1 records
This species is an occasional visitor to south and southwest coastal Western Australia. It breeds on subantarctic and antarctic islands.				
1939	1		Bunbury	Day sighting
<i>Calyptorhynchus banksii naso</i>			Forest Red-tailed Black-Cockatoo	2 records
This subspecies of the Red-tailed Black Cockatoo is restricted to the forests of the south-west. It requires tree hollows to nest and breed and is totally dependent on jarrah-marri forest.				
1999	1	3	"Green Patch"	Day sighting
2009	1	2	Eaton	Day sighting
<i>Calyptorhynchus baudinii</i>			Baudin's Black-Cockatoo	3 records
This species is a seasonal visitor to the northern forests and adjacent eastern edge of the coastal plain, feeding on the seeds of eucalypts and various proteaceous species. It breeds in spring/summer in the southern forests, nesting in tree hollows (primarily in Marri).				
1939	2		Bunbury	Day sighting
1999	1	3	Bunbury	Day sighting
2008	1	6	Bunbury	Day sighting
<i>Calyptorhynchus latirostris</i>			Carnaby's Black-Cockatoo	2 records
This species moves around seasonally in flocks to feeding areas in proteaceous scrubs and heaths and eucalypt woodlands as well as pine plantations. Breeding occurs in winter/spring, mainly in the eastern forests and wheatbelt where they can find mature hollow-bearing trees to nest in.				
1999	2	7	Bunbury	Day sighting
2003	1	1	Bunbury	Dead
<i>Psophodes nigrogularis nigrogularis</i>			Western Whipbird (western heath subsp)	1 records
This subspecies is restricted to a small area east of Albany and inhabits areas of dense shrubland and coastal heath that is long unburnt.				
1898	1	0	Bunbury	Eggs
Priority Three: Taxa with several, poorly known populations, some on conservation lands				
<i>Ixobrychus flavicollis australis</i>			Black Bittern	1 records
This species inhabits freshwater pools, swamps and lagoons, well screened with trees.				
1931	1		Picton	
Priority Four: Taxa in need of monitoring				
<i>Macropus irma</i>			Western Brush Wallaby	3 records
This species occurs in areas of forest and woodland supporting a dense shrub layer.				
1986	1	1	Gelorup	
1999	1	1	Bunbury	Day sighting

33.2637°S 115.6131°E / 33.4432°S 115.8262°E

Picton area (plus ~10km buffer) #2857

* Date	Certainty	Seen	Location Name	Method
2008	1	1	Gelorup	Day sighting

Hydromys chrysogaster **Water-rat, Rakali** *2 records*

This species occurs in waterways and wetlands that support its main prey items such as molluscs and crustaceans.

1957	1	1	Bunbury
1964	1	1	Bunbury

Burhinus grallarius **Bush Stonecurlew** *1 records*

A well camouflaged, ground nesting bird which prefers to 'freeze' rather than fly when disturbed. It inhabits lightly timbered open woodlands.

1939	1		Bunbury
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Charadrius rubricollis **Hooded Plover** *1 records*

This species frequents the margins and shallows of salt lakes, also along coastal beaches, where it forages for invertebrates along the water's edge.

1998	1	85	Leschenault	Day sighting
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Numenius madagascariensis **Eastern Curlew** *4 records*

This species is a migratory visitor and has been observed on reef flats and sandy beaches along the West Australian coast and in coastal estuaries.

1998	1	15	Leschenault	Day sighting
2000	1	7	Leschenault	
2001	1	7	Leschenault	
2004	1		Pelican Point	Day sighting

Priority Five: Taxa in need of monitoring (conservation dependent)

Isoodon obesulus fusciventer **Quenda** *3 records*

This species prefers areas with dense understorey vegetation, particularly around swamps and along watercourses, that provides ample protection from predators.

1999	1	1	Bunbury	Dead
1999	2	0	Bunbury	Definite signs
2008	1	1	Gelorup	Day sighting

* Information relating to any records provided for listed species:-

Date: date of recorded observation

Certainty (of correct species identification): 1=Very certain; 2=Moderately certain; and 3=Not sure.

Seen: Number of individuals observed.

Location Name: Name of reserve or nearest locality where observation was made

Method: Method or type of observation

Protected Matters Search Tool

You are here: [Environment Home](#) > [EPBC Act](#) > [Search](#)

16 December 2009 19:29

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Information on the coverage of this report and qualifications on data supporting this report are contained in the [caveat](#) at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

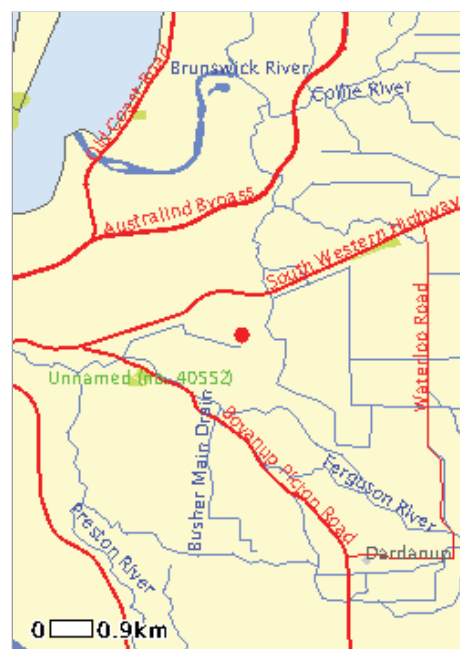
The Australian Natural Resources Atlas at <http://www.environment.gov.au/atlas> may provide further environmental information relevant to your selected area. Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Search Type: Point
Buffer: 5 km
Coordinates: -33.348528,115.729706



- Report Contents:** [Summary](#)
[Details](#)
- [Matters of NES](#)
 - [Other matters protected by the EPBC Act](#)
 - [Extra Information](#)

[Caveat](#)
[Acknowledgments](#)



This map may contain data which are
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Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Significance: (Ramsar Sites)	None

Commonwealth Marine Areas:	None
<u>Threatened Ecological Communities:</u>	1
<u>Threatened Species:</u>	9
<u>Migratory Species:</u>	7

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov.au/epbc/permits/index.html>.

<u>Commonwealth Lands:</u>	1
Commonwealth Heritage Places:	None
Places on the RNE:	None
<u>Listed Marine Species:</u>	5
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

<u>State and Territory Reserves:</u>	1
Other Commonwealth Reserves:	None
Regional Forest Agreements:	None

Details

Matters of National Environmental Significance

Threatened Ecological Communities [Dataset Information]	Status	Type of Presence
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area
Threatened Species [Dataset Information]	Status	Type of Presence

Birds[*Calyptorhynchus banksii naso*](#)

Forest Red-tailed Black-Cockatoo

Vulnerable Species or species habitat may occur within area

[*Calyptorhynchus baudinii*](#)

Baudin's Black-Cockatoo, Long-billed Black-Cockatoo

Vulnerable Breeding known to occur within area

[*Calyptorhynchus latirostris*](#)

Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo

Endangered Breeding likely to occur within area

Mammals[*Dasyurus geoffroii*](#)

Chuditch, Western Quoll

Vulnerable Species or species habitat likely to occur within area

[*Pseudocheirus occidentalis*](#)

Western Ringtail Possum

Vulnerable Species or species habitat likely to occur within area

[*Setonix brachyurus*](#)

Quokka

Vulnerable Species or species habitat may occur within area

Ray-finned fishes[*Nannatherina balstoni*](#)

Balston's Pygmy Perch

Vulnerable Species or species habitat may occur within area

Plants[*Darwinia sp. Muchea \(B.J.Keighery 2458\)*](#)

Muchea Bell

Critically Endangered Species or species habitat likely to occur within area

[*Drakaea micrantha Hopper & A.P.Brown nom. inval.*](#)

Dwarf Hammer-orchid

Vulnerable Species or species habitat likely to occur within area

Migratory Species [[Dataset Information](#)]

Status Type of Presence

Migratory Terrestrial Species**Birds**[*Haliaeetus leucogaster*](#)

White-bellied Sea-Eagle

Migratory Species or species habitat likely to occur within area

[*Merops ornatus*](#)

Rainbow Bee-eater

Migratory Species or species habitat may occur within area

Migratory Wetland Species**Birds**[*Ardea alba*](#)

Great Egret, White Egret

Migratory Breeding likely to occur within area

[*Ardea ibis*](#)

Cattle Egret

Migratory Species or species habitat may occur within area

Migratory Marine Birds[*Apus pacificus*](#)

Fork-tailed Swift

Migratory Species or species habitat may occur within area

[*Ardea alba*](#)

Great Egret, White Egret

Migratory Breeding likely to occur within area

[*Ardea ibis*](#)

Cattle Egret

Migratory Species or species habitat may occur within area

Other Matters Protected by the EPBC ActListed Marine Species [[Dataset Information](#)]

Status Type of Presence

Birds[*Apus pacificus*](#)

Fork-tailed Swift

Listed - overfly marine area Species or species habitat may occur within area

[Ardea alba](#)

Great Egret, White Egret

Listed -
overfly
marine
area

Breeding likely to occur within area

[Ardea ibis](#)

Cattle Egret

Listed -
overfly
marine
area

Species or species habitat may occur within area

[Haliaeetus leucogaster](#)

White-bellied Sea-Eagle

Listed

Species or species habitat likely to occur within area

[Merops ornatus](#)

Rainbow Bee-eater

Listed -
overfly
marine
area

Species or species habitat may occur within area

Commonwealth Lands [[Dataset Information](#)]

Unknown

Extra Information

State and Territory Reserves [[Dataset Information](#)]

Un-named (No. 46108) Nature Reserve, WA

Caveat

The information presented in this report has been provided by a range of data sources as [acknowledged](#) at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the *Environment Protection and Biodiversity Conservation Act 1999*. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the [migratory](#) and [marine](#) provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as [extinct or considered as vagrants](#)
- some species and ecological communities that have only recently been listed
- [some terrestrial species](#) that overfly the Commonwealth marine area
- migratory species that are very [widespread, vagrant, or only occur in small numbers](#).

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites;

- seals which have only been mapped for breeding sites near the Australian continent.

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments

This database has been compiled from a range of data sources. The Department acknowledges the following custodians who have contributed valuable data and advice:

- [New South Wales National Parks and Wildlife Service](#)
- [Department of Sustainability and Environment, Victoria](#)
- [Department of Primary Industries, Water and Environment, Tasmania](#)
- [Department of Environment and Heritage, South Australia Planning SA](#)
- [Parks and Wildlife Commission of the Northern Territory](#)
- [Environmental Protection Agency, Queensland](#)
- [Birds Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Atherton and Canberra](#)
- [University of New England](#)
- Other groups and individuals

[ANUcliM Version 1.8, Centre for Resource and Environmental Studies, Australian National University](#) was used extensively for the production of draft maps of species distribution. Environment Australia is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

[Department of the Environment, Water, Heritage and the Arts](#)

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Last updated: Thursday, 20-Nov-2008 14:17:56 EST

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APPENDIX E

DETAILS OF SIGNIFICANT SPECIES

Western Whipbird *Psophodes nigrogularis nigrogularis*

Status and Distribution: This subspecies of the Western Whipbird is classified as Schedule 1 under the *WAWC Act (1950)* and as Endangered under the *EPBC Act (1999)*. Originally found in South-west Western Australia along the west coast from Perth to Augusta and on the south coast from King Georges Sound east to at least Two People's Bay. Now restricted to a small area east of Albany between Mt Taylor and Cheyne Beach/Waychinicup R., notably Two People's Bay Nature Reserve and Mt Manypeaks.

Habitat: At Two Peoples Bay, the Western Whipbird occurs in dense shrubland with an open overstorey, the structure of the vegetation being more important than the floristics. All of the domed nests found have been in dense bushes in heath adjacent to thickets. On Mt Manypeaks, the subspecies also occurs in dense low mallee and shrubland. The birds feed mostly on or near the ground.

Likely presence in study area: Regionally extinct.

Potential impact of development: No impact on this species will occur as the result of development within the study area.

Hooded Plover *Charadrius rubricollis*

Status and Distribution: Listed as Priority 4 by DEC. In WA coastally west from Israelite Bay north to Jurien Bay and inland salt lakes more than 100km from the coast. In eastern Australia confined to suitable habitat from Jervis Bay (NSW) through Bass Strait and Tasmanian and west to Great Australian Bight in South Australia.

Habitat: Broad sandy ocean beaches and bays, coastal and inland salt lakes (Pizzey & Knight 2006).

Likely presence in study area: No suitable habitat.

Potential impact of development: No impact on this species will occur as the result of development within the study area.

Great Egret *Ardea alba*

Status and Distribution: This species of egret is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. The Great Egret is common and very widespread in any suitable permanent or temporary habitat (Morcombe, 2003).

Species or species habitat listed as likely to occur in general area within EPBC database search.

Habitat: Wetlands, flooded pasture, dams, estuarine mudflats, mangroves and reefs (Morcombe 2003).

Likely presence in study area: Observed in flooded paster areas during the survey period. Likely to be a frequent visitor, in low numbers during wetter months of the year. Unlikely to breed onsite.

Potential impact of proposed development: Potential for the loss of some poor quality foraging habitat, however substantial areas of similar habitat are present in surrounding farmland and no significant impact on this species is anticipated.

Cattle Egret *Ardea ibis*

Status and Distribution: This species of egret is listed as migratory under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. The Cattle Egret is common in the north sections of its range but is an irregular visitor to the better watered parts of the state (Johnstone and Storr 1998). The population is expanding (Morcombe 2003).

Species or species habitat listed as likely to occur in general area within EPBC database search.

Habitat: Moist pastures with tall grasses, shallow open wetlands and margins, mudflats (Morcombe 2003).

Likely presence in study area: Likely to be an infrequent visitor, in low numbers during wetter months of the year. Unlikely to breed onsite.

Potential impact of proposed development: Potential for the loss of some poor quality foraging habitat, however substantial areas of similar habitat are present in surrounding farmland and no significant impact on this species is anticipated.

White-bellied Sea Eagle *Haliaeetus leucogaster*

Status and Distribution: This species is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. White-bellied sea eagles are moderately common to common on Kimberley and Pilbara islands, coasts and estuaries, on Bernier, Dorre and Dirk Hartog Is., in Houtman Abrolhos and in the Archipelago of the Recherche; rare to uncommon elsewhere (Johnstone and Storr 1998). Also found in New Guinea, Indonesia,

China, southeast Asia and India. Scarce near major coastal cities (Morcombe 2003).

Species or species habitat listed as likely to occur in general area within EPBC database search.

Habitat: They nest and forage usually near the coast over islands, reefs, headlands, beaches, bays, estuaries, mangroves, but will also live near seasonally flooded inland swamps, lagoons and floodplains, often far inland on large pools of major rivers. Established pairs usually sedentary, immatures dispersive (Morcombe 2003). White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession.

Likely presence in study area: May fly over the site occasionally due to proximity to ocean and estuaries. Would however not be specifically attracted to the site as habitat unsuitable and is therefore not listed as a potential species.

Potential impact of proposed development: No impact on this species is anticipated.

Peregrine Falcon *Falco perigrinus*

Status and Distribution: This species is listed as Schedule 4 under the *WAWC Act 1950*. Individuals of this species are uncommon/rare but wide ranging across Australia. Moderately common at higher levels of the Stirling Range, uncommon in hilly, north west Kimberley, Hamersley and Darling Ranges; rare or scarce elsewhere (Johnstone and Storr 1998).

Habitat: Diverse from rainforest to arid shrublands, from coastal heath to alpine (Morcombe 2003). Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Johnstone and Storr 1998). The species utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. It will also occasionally use the abandoned nests of other birds of prey.

Likely presence in study area: The species potentially utilises some sections of the study area as part of a much larger home range. No potential nest sites observed.

Potential impact of proposed development: No impact anticipated.

Australasian Bittern *Botaurus poiciloptilus*

Status and Distribution: Classified as Schedule 1 under the *WAWC Act (1950)* and as Vulnerable under the *EPBC Act (1999)*. The species is uncommon to rare

(Morcombe, 2003), but locally common in wetter parts of south west (Johnstone and Storr 1998). Occurs north to Moora and east to Mt Arid (Johnstone and Storr 1998).

Habitat: Freshwater wetlands, occasionally estuarine; prefers heavy vegetation (Morcombe 2003) such as beds of tall dense *Typha*, *Baumea* and sedges in freshwater swamps (Johnstone and Storr 1998).

Likely presence in study area: No suitable habitat.

Potential impact of development: No impact on this species will occur as the result of development within the study area.

Black Bittern *Ixobrychus flavicollis*

Status and Distribution: Listed as Priority 2 by DEC. Occurs north to Yanchep and Northam and east to Albany (Johnstone and Storr 1998).

Habitat: Freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense waterside vegetation (Johnstone and Storr 1998).

Likely presence in study area: No suitable habitat.

Potential impact of development: No impact on this species will occur as the result of development within the study area.

Little Bittern *Ixobrychus minutus*

Status and Distribution: Listed as Priority 4 by DEC. Occurs north to Moora and east to Two Peoples Bay; accidental or on migration further north and east and on Rottnest Island and central district (Condingup district) (Johnstone and Storr 1998).

Habitat: In south dense beds of Freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of *Typha*, *Baumea* and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).

Likely presence in study area: No suitable habitat.

Potential impact of development: No impact on this species will occur as the result of development within the study area.

Bush Stone Curlew *Burhinus grallarius*

Status and Distribution: Listed as Priority 4 by DEC. Occurs over much of the western half of the state (and Kimberley) but rare to uncommon in the south of its range due to fox predation (Johnstone and Storr 1998).

Habitat: Lightly wooded country (including partly cleared forests) near daytime shelter e.g. thickets or long grass (Johnstone and Storr 1998).

Likely presence in study area: There is a single DEC database record from Bunbury 1939. No sightings since suggest the species is extinct in the general project area.

Likely presence in study area: Regionally extinct.

Potential impact of development: No impact on this species will occur as the result of development within the study area.



Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*

Status and Distribution: Listed as Scheduled 1 under the *WAWC Act (1950)* and as Vulnerable under the *EPBC Act (1999)*. Found in the humid and subhumid south west, mainly hilly interior, north to Gingin and east to Mt Helena, Christmas Tree Well, North Bannister, Mt Saddleback, Rock Gully and the upper King River (Johnstone and Storr 1998).

Habitat: Eucalypt forests, feeds on Marri, Jarrah, Blackbutt, Karri, Sheoak and Snottygobble. The Forest Red-tailed Black Cockatoo nests in the large hollows of Marri, Jarrah and Karri (Johnstone and Kirkby 1999). In Marri, the nest hollows of the Forest Red-tailed Black Cockatoo range from 8-14m above ground, the entrance is 12 – 41cm in diameter and the depth is one to five metres (Johnstone and Storr 1998).

Breeding commences in winter/spring. There are few records of breeding in the Forest Red-tailed Black Cockatoo (Johnstone and Storr 1998), but eggs are laid in October and November (Johnstone 1997; Johnstone and Storr 1998). Incubation period 29 – 31 days. Young fledge at 8 to 9 weeks (Simpson and Day 2004).

J	F	M	A	M	J	J	A	S	O	N	D

 Period in which breeding is most likely to commence
 Period in which fledging/weening could extend through

Likely presence in study area: Three individuals were observed foraging during survey period. Other foraging evidence also observed (chewed Marri nuts). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.

Potential impact of development: Potential for the loss of foraging and breeding habitat. Significance of impact will depend on areas actually affected.



Baudin's Black- Cockatoo *Calyptorhynchus baudinii*

Status and Distribution: Listed as Scheduled 1 under the *WAWC Act (1950)* and as Vulnerable under the *EPBC Act (1999)*. Confined to the south-west of Western Australia, north to Giddegannup, east to Mt Helena, Wandering, Quindanning, Kojonup, Frankland and King River and west to the eastern strip of the Swan Coastal Plain including West Midland, Byford, Nth Dandalup, Yarloop, Wokalup and Bunbury (Johnstone and Storr 1998). On the southern Swan Coastal Plain this cockatoo is in some areas resident but mainly a migrant moving from the deep south-west to the central and northern Darling Range. Between March and September most flocks move north and are concentrated in the northern parts of the Darling Range. During this period birds forage well out onto the southern Swan Coastal Plain to areas such as Harvey, Myalup, Bunbury, Capel, Dunsborough and Meelup. While generally more common in the Darling Range this species can also be common on parts of the southern Swan Coastal Plain especially in mid-August – September when flocks begin to return to their breeding quarters (Johnstone 2008).

Habitat: Mainly eucalypt forests where it feeds primarily on the Marri seeds, (Morcombe, 2003), Banksia, Hakeas and *Erodium* sp. Also strips bark from trees in search of beetle larvae (Johnstone and Storr 1998). This species of cockatoo nests in large tree hollows, 30–40 cm in diameter and more than 30 cm deep (Saunders 1974).

Baudin's Black-Cockatoo breeds in late winter and spring, from August to November or December (Gould 1972; Johnstone 1997; Saunders 1974; Saunders *et al.* 1985). Eggs laid in October (Johnstone and Storr 1998). Incubation is 28 – 30 days. Young fledge at 8 to 9 weeks (Simpson and Day 2004).

J	F	M	A	M	J	J	A	S	O	N	D

 Period in which breeding is most likely to commence
 Period in which fledging/weening could extend througho

Likely presence in study area: Foraging evidence observed during the survey period (chewed Marri nuts and Banksia cones, grubbing on marri tree trunks). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.

Potential impact of development: Potential for the loss of foraging and breeding habitat. Significance of impact will depend on areas actually affected.

Carnaby's Black- Cockatoo *Calyptrorhynchus latirostris*

Status and Distribution: Carnaby's Black Cockatoo is listed as Scheduled 1 under the *WAWC Act (1950)* and as Endangered under the *EPBC Act (1999)*. Confined to the south-west of Western Australia, north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock), Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20 km ESE of Condingup and Cape Arid; also casual on Rottnest Island (Johnstone and Storr 1998).



Habitat: Forests, woodlands, heathlands, farms; feeds on Banksia, Hakeas and Marri. Carnaby's Cockatoo has specific nesting site requirements. Nests are mostly in smoothed-barked eucalypts with the nest hollows ranging from 2.5 to 12m above the ground, an entrance from 23-30cm diameter and a depth of 0.1-2.5m (Johnstone and Storr, 1998).

Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe, 2003). Judging from records in the Storr-Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into the Jarrah – Marri forest of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain including the region between Mandurah and Bunbury. Carnaby's Black Cockatoo has been known to breed close to the town of Mandurah, as well as at Dawesville, Lake Clifton and Baldivis (pers. comm., Ron Johnstone, WA Museum) and there are small resident populations on the southern Swan Coastal Plain near Mandurah, Lake Clifton and near Bunbury. At each of these sites the birds forage in remnant vegetation and adjacent pine plantations (Johnstone 2008).

Carnaby's Black-Cockatoo lays eggs from July or August to October or November, with most clutches being laid in August and September (Saunders

1986). Birds in inland regions may begin laying up to three weeks earlier than those in coastal areas (Saunders 1977). The female incubates the eggs over a period of 28-29 days. The young depart the nest 10–12 weeks after hatching (Saunders 1977; Smith & Saunders 1986).

J	F	M	A	M	J	J	A	S	O	N	D

 Period in which breeding is most likely to commence
 Period in which fledging/weening could extend through

Likely presence in study area: Foraging evidence observed during the survey period (chewed Marri nuts and Banksia cones). A number of hollow trees present in the study area are possibly suitable for nesting though no evidence of actual breeding observed.

Potential impact of development: Potential for the loss of foraging and breeding habitat. Significance of impact will depend on areas actually affected.

Barking Owl *Ninox connivens connivens*

Status and Distribution: Listed as Priority 2 by DEC. Found north to Perth (formerly) and east to Northam, Katanning and nearly to Bremer Bay. Declining in south west (Johnstone and Storr 1998).

Habitat: Dense vegetation, especially forest and thickets of waterside vegetation such as melaleucas (Johnstone and Storr 1998). Roosts in tree hollows.

Likely presence in study area: Habitat appears very marginal for this species and it is unlikely to be specifically attracted to the site. Not listed as a potential species.

Potential impact of development: No impact on this species is anticipated.

Masked Owl *Tyto novaehollandae novaehollandae*

Status and Distribution: Listed as Priority 3 by DEC. Found north to Yanchep and east to Yealering, Gnowangerup and Albany, casual further north. Locally common in south west but generally uncommon (Johnstone and Storr 1998).

Habitat: Roosts and nests in heavy forest, hunts over open woodlands and farmlands (Morcombe, 2003). Probably breeding in forested deep south west with some autumn–winter wanderings northwards (Johnstone and Storr 1998).

Likely presence in study area: Habitat appears very marginal for this species and it is unlikely to be specifically attracted to the site. Not listed as a potential species.

Potential impact of development: No impact on this species is anticipated.

Fork-tailed Swift *Apus pacificus*

Status and Distribution: The Fork-tailed Swift is listed as migratory under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. It is a summer migrant (Oct-Apr) to Australia (Morcombe 2003).

Habitat: Low to very high airspace over varied habitat from rainforest to semi desert (Morcombe 2003).

Likely presence in study area: It is potentially an occasional summer visitor to the study area but is entirely aerial and largely independent of terrestrial habitats.

Potential impact of development: No impact on this species is anticipated.

Rainbow Bee-eater *Merops ornatus*

Status and Distribution: This species is listed as migratory under the *EPBC Act (1999)* and under international agreements to which Australia is a signatory. The Rainbow Bee-eater is a common summer migrant to southern Australia but in the north they are resident (Morcombe 2003).

Habitat: Open Country, of woodlands, open forest, semi arid scrub, grasslands, clearings in heavier forest, farmlands (Morcombe 2003). Breeds underground in areas of suitable soft soil firm enough to support tunnel building.

Likely presence in study area: Observed foraging and roosting onsite. Some areas suitable for breeding.

Potential impact of development: Despite the potential for breeding no significant impact on this species is anticipated as individuals onsite are unlikely to represent a substantial proportion of the population. It can be expected to continue to utilise the area, as it does now, despite any future development.

Chuditch *Dasyurus geoffroii*

Status and Distribution: Listed as Scheduled 1 under the *WC Act (1950)* and as Vulnerable under the *EPBC Act (1999)*. Formerly occurred over nearly 70 per cent of Australia. The Chuditch now has a patchy distribution throughout the

Jarrah forest and mixed Karri/Marri/Jarrah forest of southwest Western Australia. Also occurs in very low numbers in the Midwest, Wheatbelt and South Coast Regions with records from Moora to the north, Yellowdine to the east and south to Hopetoun.

Habitat: Chuditch are known to have occupied a wide range of habitats from woodlands, dry sclerophyll (leafy) forests, riparian vegetation, beaches and deserts. Riparian vegetation appears to support higher densities of Chuditch, possibly because food supply is better or more reliable and better cover is offered by dense vegetation. Chuditch appear to utilise native vegetation along road sides in the wheatbelt (CALM 1994). The estimated home range of a male Chuditch is over 15 km² whilst that for females is 3-4 km² (Sorena and Soderquist 1995).

Likely presence in study area: Locally extinct. Habitat within the study area is not suitable for a population of this species to persist.

Potential impact of development: No impact on this species is anticipated.

Southern Brush-tailed Phascogale *Phascogale tapoatafa tapoatafa*

Status and Distribution: Listed as Scheduled 1 under the *WAWC Act (1950)*. Present distribution is believed to have been reduced to approximately 50 per cent of its former range. Now known from Perth and south to Albany, west of Albany Highway. Occurs at low densities in the northern Jarrah forest. Highest densities occur in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (DEC information pamphlet). Records are less common from wetter forests.

Habitat: This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. A nocturnal carnivore relying on tree hollows as nest sites. The home range for a female Brush-tailed Phascogale is estimated at between 20 and 70 ha, whilst that for males is given as twice that of females. In addition, they tend to utilise a large number (approximately 20) of different nest sites throughout their range (Soderquist, 1995).

Likely presence in study area: Better quality vegetation present to the west of the study area (Lot 200) maybe suitable, though the total area of the remnant would limit the long term viability of a population. Limited suitable habitat within the study area is marginal and would be unlikely to support a population of this species.

Potential impact of development: No impact on this species is anticipated.

Quenda *Isoodon obesulus fusciventer*

Status and Distribution: Listed as Priority 5 by DEC. Widely distributed in the south west from near Cervantes north of Perth to east of Esperance, patchy distribution through the Jarrah and Karri forest and on the Swan Coastal Plain, and inland as far as Hyden. Has been translocated to Julimar State Forest, Hills Forest Mundaring, Tutanning Nature Reserve, Boyagin Nature Reserve, Dongolocking Nature Reserve, Leschenault Conservation Park, and Karakamia and Paruna Sanctuaries (DEC information pamphlet) and Nambung National Park (DEC pers. coms.)

Habitat: Dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. Quendas can thrive in more open habitat subject to exotic predator control (DEC information pamphlet).

Likely presence in study area: There is very limited areas of suitable habitat for this species to persist within the study area (dense groundcover) and it is unlikely that a population could exist on site.

Potential impact of development: No impact on this species is anticipated.

Western Ringtail Possum *Pseudocheirus occidentalis*

Status and Distribution: Listed as Scheduled 1 under the *WAWC Act (1950)* and as Vulnerable under the *EPBC Act (1999)*. Common in suitable habitat (de Tores 2008). The highest densities of this species are recorded in Peppermint habitat near Busselton area; relatively high densities are found in Jarrah/Marri forest at Perup (de Tores 2008).

The Western Ringtail Possum has a restricted distribution in south-western Western Australia. Most known populations (natural and translocated) are now restricted to near coastal areas of the south west from the Dawesville area to the Waychinicup National Park. Inland, it is also known to be relatively common in a small part of the lower Collie River valley, the Perup Nature Reserve and surrounding forest blocks near Manjimup. It was recently recorded in stands of Peppermint near the Harvey River and in Jarrah/Marri forest near Collie; however, the long term persistence of the species in these areas is not confirmed (de Tores et al. 2004). The Western Ringtail was formerly more widespread: in the 1970s it was known from Casuarina woodlands in the wheatbelt near Pingelly (south-east of Perth), and it is thought to have once occurred throughout much of

south-western Western Australia (but not necessarily continuously distributed) (Maxwell et al. 1996; de Tores 2008).

The species is widespread and relatively common in vegetated remnants within the Swan Coastal Plain and along the Whicher Scarp between Bunbury and Busselton (G. Harewood per. obs.). Most northern known natural population is centred on the Binningup townsite.

Habitat: The Western Ringtail Possum was once located in a variety of habitats including Coastal Peppermint, Coastal Peppermint-Tuart, Jarrah-Marri associations, Sheoak woodland, and eucalypt woodland and mallee. Coastal populations mostly inhabit Peppermint-Tuart associations with highest densities in habitats with dense, relatively lush vegetation. In these areas the main determinants of suitable habitat for WRP appears to be the presence of *Agonis flexuosa* either as the dominant tree or as an understorey component of Eucalypt forest or woodland (Jones *et al.* 1994a). Inland, the largest known populations occur in the Upper Warren area east of Manjimup (Wayne *et al.* 2005). In this area the peppermint tree is naturally absent and jarrah-marri associations constitute the species refuge and foraging habitat.

Likely presence in study area: Appears to be present in low numbers in some sections of the study area. Evidence observed (dreys and scats) is possibly the result of transient individuals temporally residing in the area as opposed to a viable resident population. Despite current population levels significant areas of remnant vegetation on site represents potential habitat that may be considered important for recovery of the species in the long term.

Potential impact of development: Potential for the loss of foraging, refuge and/or dispersal habitat. Significance of impact will depend on areas actually affected.

Quokka *Setonix brachyurus*

Status and Distribution: Listed as Scheduled 1 under the *WC Act* (1950) and as Vulnerable under the *EPBC Act* (1999). Rare and restricted in south west W.A. from south of Perth to Two Peoples Bay. The distribution of the Quokka includes Rottnest and Bald Islands, and at least 25 known sites on the mainland, including Two Peoples Bay Nature Reserve, Torndirrup National Park, Mt Manypeaks National Park, Walpole-Nornalup National Park, and various swamp areas through the south-west forests from Jarrahdale to Walpole.

Species or species habitat listed as likely to occur in general area within EPBC database search.

Habitat: Mainland populations of this species are currently restricted to densely vegetated coastal heaths, swamps, riverine habitats including tea-tree thickets on sandy soils along creek systems where they are less vulnerable to predation. The species is nocturnal

Likely presence in study area: No suitable habitat.

Potential impact of development: No impact on this species is anticipated.

Western Brush Wallaby *Macropus irma*

Status and Distribution: Listed as Priority 4 by DEC. The Western Brush Wallaby is distributed across the south-west of Western Australia from north of Kalbarri to Cape Arid (DEC information pamphlet).

Habitat: The species optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest (DEC information pamphlet).

Likely presence in study area: Locally extinct. Remnants with the study area are too small and isolated to support a population or even transient individuals of this species.

Potential impact of development: No impact on this species is anticipated.

Western False Pipistrelle *Falsistrellus mackenziei*

Status and Distribution: Listed as Priority 4 by DEC. Listed as vulnerable by the IUCN. Confined to south west W.A. south of Perth and east to the wheat belt. Most records from Karri forests but also recorded in wetter stands of jarrah and tuart and woodlands on the Swan Coastal Plain (Menkhorst and Knight 2001). Range appears to be contracting southwards, presumably due to drying climate.

Habitat: This species of bat occurs in high forest and coastal woodlands. It roosts in small colonies in tree hollows and forages at canopy level and in the cathedral-like spaces between trees.

Likely presence in study area: Status in the area difficult to determine. May at least forage on site.

Potential impact of development: Potential for the loss of roosting habitat (hollow trees).

Water Rat *Hydromys chrysogaster*

Status and Distribution: Listed as Priority 4 by DEC. The water rat is widely distributed around Australia and its offshore islands, New Guinea and some adjacent islands. It occurs in fresh brackish water habitats in the south-west of Western Australia, but occurs in marine environments along the Pilbara coastline and offshore islands. Previous survey work in the south west suggested this species was relatively common and widespread though difficult to capture (Christensen *et al* 1985, How *et al* 1987).

Habitat: The water rat occupies habitat in the vicinity of permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south west (Christensen *et al* 1985).

Likely presence in study area: This species is unlikely to persist onsite.

Potential impact of development: No impact on this species is anticipated.



Appendix C

Preliminary Acid Sulphate Soil Investigation

Preliminary Acid Sulphate Soil Investigation

Picton East, Shire of Dardanup,
WA



Prepared for
TME Group
by Strategen

May 2010

Preliminary Acid Sulphate Soil Investigation

Picton South – Eastern Sector – Shire of
Dardanup, WA

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May 2010

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Client: TME Group

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Draft Report	V1	ZC/DD	AP	1	19/5/2010
Final Report	Final	ZC/DD	AP	1	31/5/2010

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1. INTRODUCTION

The following report is a Preliminary Acid Sulphate Soil (ASS) Investigation undertaken for a land parcel (the study area) known as the Picton South site (eastern sector), which is bordered by Martin Pelusey Road, Harris Road, Columbas Drive, a section of disused railway line to the south west and the Perth to Bunbury railway line, and is located in the Shire of Dardanup, WA. The study area is proposed to be developed for light commercial use and will incorporate access roads and other services. Strategen was appointed by TME Group to undertake the investigation in order to develop an understanding of any potential ASS issues associated with excavations that may be undertaken within the study area, particularly in association with the provision of power and deep sewage services and stormwater management.

South West Chemical Services (SWCS) was sub-contracted by Strategen to carry out the Preliminary ASS field work, which was conducted on 12 May 2010. Previous investigations carried out to the south west of the study area, opposite Lot 200 Harris Road, showed some evidence of Potential Acid Sulphate Soils (PASS¹) in a low lying area. In addition, some evidence of Actual Acid Sulphate Soils (AASS²) was observed in the upper soil layers and towards the Ferguson River at Lot 51 Martin Pelusey Rd, located to the south of the study area.

1.1 OVERVIEW OF STUDY AREA

The study area, as illustrated in Figure 2, comprises approximately 140 ha of low lying land split into seven lots, the majority of which has been cleared for grazing and industrial purposes. Some small pockets of lightly treed, native vegetation have been retained in slightly elevated areas associated with sandy soils. The surface levels range from 12 to 25 m Australian Height Datum (AHD).

1.1.1 Geology and soils

Geological maps for the study area show the site to be underlain by the Guildford Formation, consisting of clay, silt, sand and gravels, with the Bassendean Sands outcropping in some areas. Both the Pinjarra and Bassendean soil systems dominate the study area (Figure 1 – Department of Agriculture 2003). The Pinjarra P2 phase consists of flat to very gently undulating plains with poor to imperfectly drained, deep alkaline mottled, yellow duplex soil, which generally consist of shallow pale sand to sandy loam over clay (Department of Agriculture 2003). The Bassendean B1a phase consists of extremely low to very low relief dunes, undulating sandplain and discrete sand rises where soils are deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface with marri and jarrah vegetation dominating the system (Department of Agriculture 2003).

¹ Potential acid sulphate soils (PASS) are soils or sediments which contain iron sulphides and/or other sulphidic minerals that have not been oxidised or exposed to air (DoE 2006).

² Actual acid sulphate soils (AASS) are soils or sediments which contain iron sulphides and/or other sulphidic minerals that have previously undergone some oxidation to produce sulphuric acid (DoE 2006).

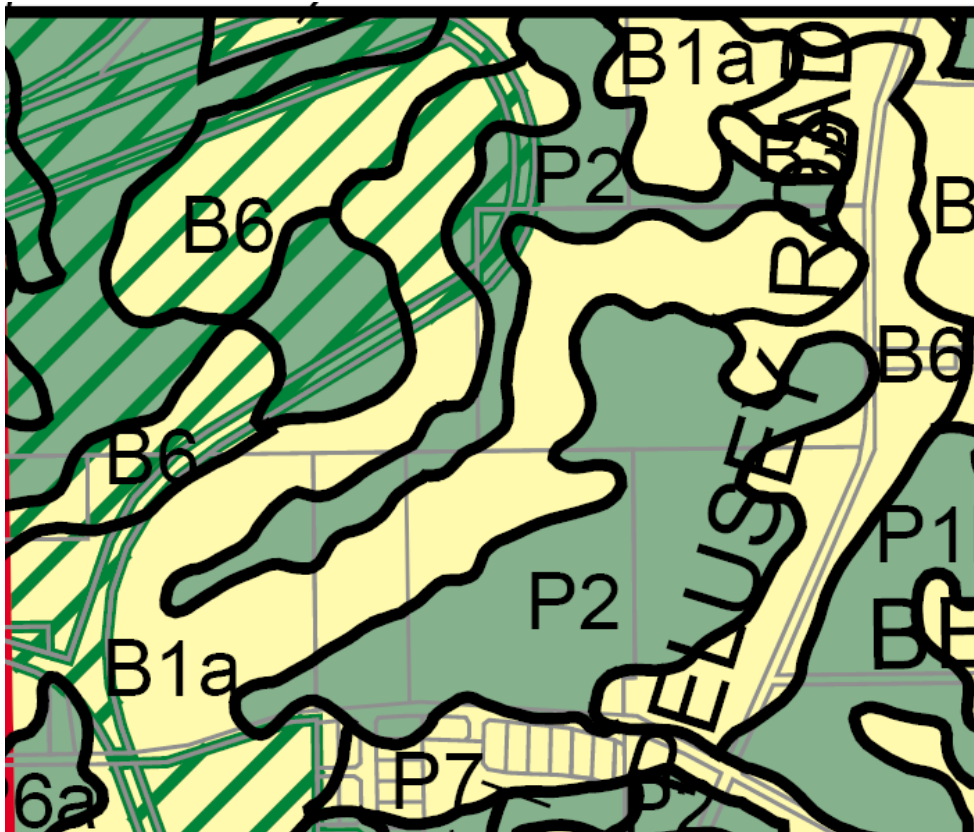


Figure 1 Soil map units within the study area

According to Western Australian Planning Commission (WAPC) Planning Bulletin 64, the site is in an area with a moderate to low risk of AASS and PASS occurring generally at depths greater than 3 m (Appendix 1).

1.1.2 Lot descriptions

The study area consists of 7 lots, comprising of:

Lot 1 – 31.6 ha of low-lying, predominantly cleared land used for horse breeding, with some moderate sized pockets of native vegetation. Part of the Lot appears to be an old sand extraction site and it has a highly modified upper soil layer consisting of predominantly fill material and builder's rubble.

Lot 11 – 11.9 ha of low-lying, predominantly cleared land used for horse breeding and training.

Lot 603 – 39.2 ha consisting of a small, cleared, low-lying area, as well as a large, slightly elevated ridge of remnant native vegetation on sandy soil.

Lot 103 – 17.1 ha of predominantly cleared, low-lying land with a small pocket of native vegetation to the north-west.

Lot 2 – 21.2 ha of almost entirely cleared, low-lying land, occupied in part by a shed used for industrial purposes.

Lot 102 – 6.3 ha of predominantly low-lying land with a slight ridge containing small amounts of vegetation.

Lot 104 – 8.6 ha of predominantly vegetated, low-lying land with areas containing piles of construction rubble.

1.2 SCOPE OF INVESTIGATION

Strategen commissioned South West Chemical Services to undertake the field work component of the Preliminary ASS Assessment of the study area. The intent of the preliminary assessment was to undertake the boring of 10 holes at pre-determined locations on the Lots using a hand auger to the depth of 2.5 m (Figure 2). Bore hole locations were considered representative of the varying elevations, soils and land types within the study area, as well as focussing on areas with a potentially higher risk of ASS. At each of the bored holes, samples were to be collected for analyses at 0.25 m vertical intervals in accordance with the Department of Environment and Conservation (DEC) *Identification and Investigation of acid sulphate soils and acidic landscapes* Guidelines (DEC 2009).

As the study area comprises approximately 140 ha, the Preliminary ASS Assessment does not constitute a full assessment in accordance with DEC Guidelines, but is intended to give an indication as to whether ASS may exist on the site. A full site assessment would entail a total of 280 holes across the full site (i.e. two holes per hectare).



Figure 2 Lot numbers and location of auger holes within the study area

2. SOIL SAMPLING

A site visit to undertake the Preliminary ASS investigation was conducted on 12 May 2010. During the initial work it became obvious that it would not be possible to complete 10 sample holes using a hand auger due to the nature of the soils at the study site. A total of six auger holes were sampled to varying depths and soil observations were made (Table 1).

Table 1 Soil observations during hand augering

Hole No.	Lot No.	Observations
8	102	Significant groundwater observed at just less than 1 m below ground level followed by a hard hand auger impenetrable layer at 1 m. The soils generally were light brown or yellow brown of fine to medium grained sands.
9	103	Gave similar results to hole 8 with water observed at 1 m. While no refusal was encountered, the large quantity of groundwater made sample collection at greater than 1.5 m impossible. The soils were generally light brown to grey/brown of fine to medium grained sands to 1 m with clayey sands at lower depths.
5	104	Located near the disused railway line, refusal was experienced at 1 m. No groundwater was encountered but the soil and gravel was damp. The soils were generally brown to yellow /brown sands and gravel.
4	603	Attempted near the maximum elevation of the sand hill that runs across the site roughly from east to west. Samples were collected to a depth of 2.25 m as the dry sand around that depth kept collapsing into the hole and were difficult to retrieve. The soil was very dry yellow sand to the depth of 2.25 m.
2	11	Samples were yielded to a depth of 2.25 m, with groundwater encountered at 1.25 m. Samples could not be collected below 2.25 m as it became increasingly difficult to remove the hand auger. The soils consisted of light brown sand to 0.5 m followed by blue/green/grey sands to 2 m. The sample collected at 2.25 m was grey clay.
1	1	The area appeared to be an old sand extraction site consisting of fill material and builder's rubble. Sampling could not be achieved at 0.25 m due to the presence of coarse builder's rubble. A further sample site was selected but samples could only be achieved to 0.5 m. The sampled soil appeared to be a dark brown sandy top soil.

It was determined that sampling the remaining four auger holes (hole numbers 3, 6, 7 and 10) would not yield sufficiently different results to those already encountered. This was because the location of holes 7 and 10 appeared to be similar in elevation and appearance to the areas sampled at holes 8 and 9, and it was likely that groundwater would be encountered. Similarly the locations of holes 3 and 6 appeared to be similar in elevation and appearance to the areas sampled at holes 4 and 5.

Samples from each of the six auger holes were collected at 0.25 m vertical intervals and immediately placed in sealed bags on ice. The samples were then transported to the SWCS laboratory and were immediately tested for field pH (pH_f) and oxidised field pH (pH_{fox}). The samples were then dried for 48 hours at 85°C for preservation and storage. The generally negative results from the field test conducted on the six completed holes confirmed the decision not to proceed with further sampling of the remaining four holes.

3. SOIL TEST RESULTS

3.1 FIELD TESTING

Details of the field test results are presented in Appendix 2. The field test results were assessed using the following criteria:

- (a) pH_f less than 4
- (b) pH_{fox} less than 4 and/or
- (c) the change in pH was greater than 2 (where the resultant pH_{fox} was less than 4) and/or
- (d) there was a strong reaction following addition of hydrogen peroxide.

The key findings from the field test results were:

- of the 36 samples tested, there were no samples where the pH_f was 4.0 or less
- of the 36 samples there were two (2) samples where the pH_{fox} was 4 or less
- of the 36 samples there were no samples that gave a change in pH > 2 units with the $\text{pH}_{\text{fox}} < 4.0$
- 1 sample gave a High reaction with the addition of Hydrogen Peroxide
- 3 samples gave an Extreme reaction with gas evolution and heat with the addition of Hydrogen Peroxide
- There appears to be no indication of the presence of PASS at all levels in the samples processed
- There may be an indication of Actual Acid Sulphate soils in samples collected from hole 2, hole 5 and hole 8.

3.2 DETAILED LABORATORY TESTING AND ASSESSMENT

No full laboratory assessment has been carried out at this stage.

4. CONCLUSIONS

Results of the field tests indicate a potential for AASS, particularly in the vicinity of holes 2 and 8 (Lots 11 and 102). Samples exposed to gas evolution and heat with the addition of hydrogen peroxide produced an extreme reaction in three samples at depths of 1.75 – 2.25 m for hole 2, and a high reaction in one sample at a depth of 0.75 m for hole 8. In addition, potential for AASS may also occur in the vicinity of hole 5 (Lot 104), where two surface samples (0.25 – 0.5 m) experienced a pH_{fox} of 4 or less. However, there appears to be no indication of the presence of PASS at all levels in the samples processed from these holes.

The overall results of the Preliminary ASS Investigation are limited due to the low number of samples collected using a hand auger. This outcome is the result of the soil types encountered within the study area and the presence of groundwater close to the surface in some locations. In the event that any future studies are undertaken, more accurate results at depth may be obtained using equipment such as Geoprobe boring or an excavator.

For a thorough indication of the potential for ASS within the study area, a more detailed investigation that follows full DEC guidelines is recommended for areas where field tests indicated a potential for ASS (in the vicinity of holes 2, 8 and 5), as well as areas of similar soil characteristics that weren't sampled during the site investigation. To obtain a detailed assessment of ASS potential within the entire study area, a full investigation aligning with DEC requirements (i.e. two holes per hectare across the entire site) would need to be undertaken.

5. REFERENCES

Department of Agriculture WA (2003), *AgMaps Land Profiler*, Sheet 1 – Shire of Capel, CD-ROM, Government of Western Australia.

Department of Environment and Conservation (January 2009), *DRAFT Treatment and management of soils and water in acid sulphate soil landscapes*, Acid Sulphate Soils Guideline Series, Government of Western Australia.

Department of Environment and Conservation (May 2009), *Identification and Investigation of acid sulphate soils and acidic landscapes*, Acid Sulphate Soils Guideline Series, Government of Western Australia.

Queensland Department of Natural Resources, Mines and Energy (Qld NRM&E) (June 2004), *Acid Sulphate Soils, Laboratory Methods Guidelines*, Version 2.1 – Joint project of Queensland Acid Sulphate Soils Investigation Team (QASSIT), Southern Cross University (SCU), National Committee for Acid Sulphate Soils (NatCASS), Queensland Acid Sulphate Soils Management Advisory Committee (QASSMAC) and New South Wales Acid Sulphate Soils Management Advisory Committee (ASSMAC).

Western Australian Planning Commission (November 2003), *Acid Sulfate Soils*, Planning Bulletin Number 64, Figure 8: Australind – Bunbury Acid Sulfate Soils, Western Australia.

Appendix 1
Planning Bulletin
Number 64: Australind –
Bunbury Acid Sulphate
Soils

Appendix 2
South West Chemical
Services – Field Test
Results

Certificate of Analysis

Client Name:	Strategen Attn: Roger Banks		
Address:	PO Box 287, Bunbury, WA 6231		
Phone No:	9792 4797	Fax:	9792 4708
Lab No:	4918	Email:	r.banks@strategen.com.au
Date samples received:	12/05/10	Report date:	14/05/10

Sample details: 36 Soil samples collected David Dodds and Zac Cockerill from 6 bore holes drilled using a hand auger at a site near the corner Harris Rd and Martin Pelusey Rd Dardanup, WA
The site is in an area of Moderate to Low risk of ASS occurring within 3 m of the natural soil surface.
Hole 1 Location GPS coordinates 50H 0382014 6309818 depth to 0.5 m
Hole 2 Location GPS coordinates 50H 0381617 6309801 depth to 2.25 m
Hole 4 Location GPS coordinates 50H 0381856 6309461 depth to 2.25 m
Hole 5 Location GPS coordinates 50H 0381146 6309216 depth to 1.0 m
Hole 8 Location GPS coordinates 50H 0381353 6308671 depth to 1.5 m
Hole 9 Location GPS coordinates 50H 0381580 6308647 depth to 1.5 m
Samples were immediately placed on ice and transferred to refrigerated storage.
A portion of the sample was removed for Field pH (pH_f) and oxidised Field pH (pH_{fox}), the remainder has been preserved by drying for 48 hours at 85°C

Scope of Work: Acid Sulphate Soils Field Tests pH_f , pH_{fox} , Reaction rating, Fizz test
Preservation of retained samples, Interpretation of results.

Test Methods: Acid Sulphate Soils Laboratory Methods Guidelines Version 2.1 Section H:Field Tests June 2004, Queensland Government, Natural Resources, Mines and Energy.
Draft Identification & Investigation of Acid Sulphate Soils, prepared by Land & Water Quality Branch, DoE, WA May 2006
pH tested using Eutech WP pHScan BNC with Ionode Intermediate Junction pH combination electrode IJ48F calibrated according to manufacturer's instructions.

Test Results:

The field test results were assessed using the following criteria

- a) pH_f less than 4
- b) pH_{fox} less than 4 and /or
- c) the change in pH was greater than 2 (where the resultant pH_{fox} was less than 4) and/or
- d) there was a strong reaction following addition of hydrogen peroxide

Results meeting these criteria have been highlighted.

Of the 36 samples tested, there were no samples where the pH_f was 4.0 or less

Of the 36 samples there were 2 sample where the pH_{fox} was 4 or less

Of the 36 samples there were no samples that gave a change in pH > 2 units with the pH_{fox} <4.0

1 sample gave a High reaction with the addition of Hydrogen Peroxide, 3 samples gave an Extreme reaction with gas evolution and heat with the addition of Hydrogen Peroxide.

'Actual acid sulphate soils (AASS) are soils or sediments which contain iron sulphides and/or other sulphidic minerals that have previously undergone some oxidation to produce sulphuric acid.' (DoE 2006)

'Potential acid sulphate soils (PASS) are soils or sediments which contain iron sulphides and/or other sulphidic minerals that have not been oxidised or exposed to air.' (DoE 2006)

There appears to be a no indication of the presence Potential Acid Sulphate soils at all levels in the samples processed.

There may be an indication of Actual Acid Sulphate soils in the samples collected from Hole 2 at 250 mm depth, Hole 5 at 250 mm and 500 mm depth.

All samples are being dried at 85°C for 48 hours.

If you have any further questions relating to this report and its interpretation please telephone South West Chemical Services on 08 9721 7170

David Dodds

Dip.App.Chem. A.G.Inst.Tech

Lab No: 4918
Hole No: Bore Hole 1
Hole Depth: 0.50 metre

Date Sampled: 12/05/10
Location: 0382014E
6309818N

Hole ID	Depth m	Soil Texture	pHf	pHfox	pHf - pHfox	Reaction	Fizz Test
				pH _{H2O2} =4.95			
1	0.25	fine dark brown sandy top soil	7.45	5.85	1.60	L	N
	0.50	orange brown fine to med grained sand	7.95	6.15	1.80	M	XX

Reaction Rating N = none L = low M = medium H = high X = extreme V = volcanic

N - no visible or audible reaction, X – slight reaction, XX – moderate reaction, XXX – high reaction, XXXX – Vigorous reaction, gas evolution, heat generation

Lab No: 4918
Hole No: Bore Hole 2
Hole Depth: 2.25 metre

Date Sampled: 12/05/10
Location: 0381617E
6309801N

Hole ID	Depth m	Soil Texture	pHf	pHfox	pHf - pHfox	Reaction	Fizz Test
				pH _{H2O2} =4.95			
2	0.25	light brown fine to medium grained sand	4.95	4.40	0.55	L	N
	0.50	light brown fine to medium grained sand	5.85	4.90	0.95	L	N
	0.75	blue/grey/green and brown sand - damp	6.75	5.05	1.70	N	N
	1.00	blue/grey/green and brown sand + gravel - damp	6.75	4.75	2.00	N	N
	1.25	blue/grey/green sand - wet	6.95	6.05	0.90	L	N
	1.50	blue/green/yellow sand - wet	7.55	6.80	0.75	L	N
	1.75	blue/green/grey sand - wet	7.65	7.95	-0.30	X	N
	2.00	blue/green/grey sand - wet	7.65	7.90	-0.25	X	N
	2.25	grey clay	6.90	7.50	-0.60	X	N

Reaction Rating N = none L = low M = medium H = high X = extreme V = volcanic

N - no visible or audible reaction, X – slight reaction, XX – moderate reaction, XXX – high reaction, XXXX – Vigorous reaction, gas evolution, heat generation

Lab No: 4918
Hole No: Bore Hole 4
Hole Depth: 2.25 metre

Date Sampled: 12/05/10
Location: 0381856E
6309461N

Hole ID	Depth m	Soil Texture	pHf	pHfox	pHf - pHfox	Reaction	Fizz Test
				pH _{H2O2} =4.95			
4	0.25	brown/yellow fine sand	7.00	5.40	1.60	L	N
	0.50	yellow fine to med grained sand	7.20	5.35	1.85	L	N
	0.75	yellow fine to med grained sand	7.30	5.30	2.00	L	N
	1.00	yellow fine to med grained sand	7.25	5.25	2.00	L	N
	1.25	yellow fine to med grained sand	7.20	5.30	1.90	N	N
	1.50	yellow fine to med grained sand	7.30	5.25	2.05	L	N
	1.75	yellow fine to med grained sand	7.40	5.25	2.15	L	N
	2.00	yellow fine to med grained sand	7.35	5.25	2.10	L	N
	2.25	yellow fine to med grained sand	7.40	5.25	2.15	L	N

Reaction Rating N = none L = low M = medium H = high X = extreme V = volcanic

N - no visible or audible reaction, X – slight reaction, XX – moderate reaction, XXX – high reaction, XXXX – Vigorous reaction, gas evolution, heat generation

Lab No: 4918
Hole No: Bore Hole 5
Hole Depth: 1.00 metre

Date Sampled: 12/05/10
Location: 0381146E
6309216N

Hole ID	Depth m	Soil Texture	pHf	pHfox	pHf - pHfox	Reaction	Fizz Test
				pH _{H2O2} =4.95			
5	0.25	dark brown silty sand	4.60	4.00	0.60	L	N
	0.50	brown fine to med grained sand + gravel	4.95	3.90	1.05	N	N
	0.75	yellow/brown fine to med grained sand + gravel - damp	5.95	5.05	0.90	L	N
	1.00	yellow/brown fine to med grained sand + gravel - damp	6.30	5.15	1.15	N	N

Reaction Rating N = none L = low M = medium H = high X = extreme V = volcanic

N - no visible or audible reaction, X – slight reaction, XX – moderate reaction, XXX – high reaction, XXXX – Vigorous reaction, gas evolution, heat generation

Lab No: 4918
Hole No: Bore Hole 8
Hole Depth: 1.50 metre

Date Sampled: 12/05/10
Location: 0381353E
6308671N

Hole ID	Depth m	Soil Texture	pHf	pHfox	pHf - pHfox	Reaction	Fizz Test
				pH _{H2O2} =4.95			
8	0.25	light brown fine – medium grained sand	5.70	4.25	1.45	L	N
	0.50	light brown fine to medium grained sand	6.55	5.50	1.05	N	N
	0.75	light brown/yellow fine to medium grained sand - damp	7.10	6.60	0.50	H	N
	1.00	brown/yellow fine – medium grained clayey sand - wet	7.40	6.95	0.45	M	N
	1.25	brown/yellow fine – medium grained clayey sand - wet	7.40	6.35	1.05	L	N
	1.50	brown/yellow/grey sand - wet	7.20	6.30	0.90	L	N

Reaction Rating N = none L = low M = medium H = high X = extreme V = volcanic

N - no visible or audible reaction, X – slight reaction, XX – moderate reaction, XXX – high reaction, XXXX – Vigorous reaction, gas evolution, heat generation

Lab No: 4918
Hole No: Bore Hole 9
Hole Depth: 1.50 metre

Date Sampled: 12/05/10
Location: 0381580E
6308647N

Hole ID	Depth m	Soil Texture	pHf	pHfox	pHf - pHfox	Reaction	Fizz Test
				pH _{H2O2} =4.95			
9	0.25	light brown/grey fine – medium grained sand	6.20	4.75	1.75	N	N
	0.50	grey/brown fine to medium grained sand	7.00	5.30	1.70	L	N
	0.75	brown fine to medium grained sand - damp	6.95	5.50	1.45	L	N
	1.00	grey/brown fine – medium grained sand - damp	6.65	5.35	1.30	N	N
	1.25	orange/brown fine – medium grained clayey sand - wet	5.70	4.50	1.20	L	X
	1.50	grey clayey sand - wet	6.50	4.75	1.75	L	N

Reaction Rating N = none L = low M = medium H = high X = extreme V = volcanic

N - no visible or audible reaction, X – slight reaction, XX – moderate reaction, XXX – high reaction, XXXX – Vigorous reaction, gas evolution, heat generation



Appendix D

Species List



Table 8 Forage trees species

Family	Species	Common Name	Part Consumed
Casuarinaceae	<i>Allocasuarina fraseriana</i>	Sheoak	seed
Mimosaceae	<i>Acacia saligna</i>	Orange Wattle	bark, invertebrates
Myrtaceae	<i>Agonis flexuosa</i>	Peppermint Tree	bark, invertebrates
Myrtaceae	<i>Corymbia calophylla</i>	Marri	Seed, flower, nectar
Myrtaceae	<i>Eucalyptus gomphocephala</i>	Tuart	flower
Myrtaceae	<i>Eucalyptus marginata</i>	Jarra	seed
Proteaceae	<i>Banksia attenuata</i>	Slender Banksia	seed, flower, invertebrate
Proteaceae	<i>Banksia grandis</i>	Bull Banksia	seed, flower
Proteaceae	<i>Banksia ilicifolia</i>	Holly Banksia	seed
Proteaceae	<i>Banksia littoralis</i>	Swamp Banksia	seed, flower
Proteaceae	<i>Banksia nivea</i>	Couch Honeypot	seed, flower
Proteaceae	<i>Banksia sessilis</i>	Parrot Bush	seed, flower
Proteaceae	<i>Grevillea pilulifera</i>	Woolly-flowered Grevillea	
Proteaceae	<i>Grevillea wilsonii</i>	Native Fuchsia	
Proteaceae	<i>Hakea lissocarpa</i>	Honey Bush	seed
Proteaceae	<i>Hakea prostrata</i>	Harsh Hakea	seed
Proteaceae	<i>Hakea sulcata</i>	Furrowed Hakea	seed
Proteaceae	<i>Hakea varia</i>	Variable-leaf Hakea	seed
Proteaceae	<i>Isopogon attenuatus</i>		
Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>	Grass Tree	seed



Table 9 Endemic Tree species in the Bunbury area that are used by Black Cockatoo species.

Family	Species	Common Name	Purpose
Myrtaceae	<i>Corymbia calophylla</i>	Marri	Observed breeding
Myrtaceae	<i>Eucalyptus gomphocephala</i>	Tuart	Observed breeding
Myrtaceae	<i>Eucalyptus marginata</i>	Jarraah	Observed breeding



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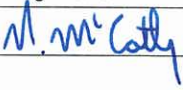
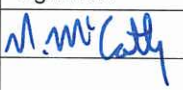
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